COST ACCOUNTING PROCEDURE

ONE OF A CO-ORDINATED SERIES OF HIGHER ACCOUNTANCY TEXTS

by

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THE PURPOSE AND PLAN

The purpose of this text on Cost Accounting Procedure is to explain and demonstrate the principles and practical applications of modern cost accounting procedure, both as they relate to the student of higher accountancy and to the work of the practical accountant. It deals with the problem of determining the cost of making and selling a product together with the organization and administrative control necessary to bring this about.

In the retail and wholesale business we are able to obtain the cost of goods sold by recording the cost of goods purchased and by determining the inventory of goods on hand. Inventory values at cost are readily ascertainable from invoices of vendors and from invoices of freight and other charges. Market values are determined from existing market prices at the time the inventory is taken.

In the manufacturing business a more difficult problem arises. No reference can be made to a vendor's invoice to determine the cost of inventories of goods in process and finished goods. The cost of the finished product can be determined only by assigning to it the cost of raw material, labor, and manufacturing expenses which were incurred in its manufacture.

One of the chief functions of the cost accountant is to record the transformation of these basic cost elements into the finished product. In so doing, his work is focused on securing the most efficient utilization of expenditures in the manufacturing process. By knowing what costs are, the cost accountant determines also what costs ought to be, and, by reconciling the two, he becomes one of the most important factors in successful business management. His work is vital in eliminating the waste in materials, labor, and over-

head costs. It is important in effecting sound manufacturing policies and organization. The subject involves that interesting question of standard costs.

An understanding of the principles, methods, and applications of modern cost accounting is essential to every accountant. To aid in visualizing the routine of cost procedure, we have used many illustrations of typical cost procedures. The charts, presented as inserts, showing the steps involved in accounting for various phases of cost procedure have been prepared with much effort and thought and should be diligently studied. A mastery of the subject demands that the accountant keep constantly before him the relationship of each part of the cost accounting scheme to the main objective sought.

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Chapter I

THE VALUE AND ELEMENTS OF COST ACCOUNTING

The ultimate aim of all cost accounting is not merely to determine the cost of manufacturing, the selling cost, or any of the score or more of costs included in the manufacture and sale of a product, but, rather, to first ascertain accurately each and every cost involved, and then to use these cost figures intelligently for the successful management of a business. Any attempt to make a cost system function profitably without serving this twofold purpose is little short of a waste of time, energy, and money.

To be sure, a factory cost system, if it serves no other purpose than to reveal the cost of manufacture, may be of some value. The mere knowledge, however, of what it costs to produce an article, without using this knowledge to reduce or control production costs, not only devitalizes a cost system of its main function —cost control and cost reduction—but leaves little, if any, justification for its existence.

It is evident then, that it is the uses to which a cost system is put, and not the mere fact that it uncovers the cost of production, which determines its value. In the last analysis, properly assembled cost figures are indexes of management or mismanagement and guide posts to chart the way for more efficient production methods. But such figures cannot serve this important purpose unless the factory executive reads be-

tween the lines of his cost reports and translates his cost figures into terms of better management methods.

Accurate Cost Affects Public Policy. This function of cost accounting is emphasized particularly in the Robinson-Patman Act, which makes illegal unfair discriminations in trade practice. In this Act price differentials are limited to those "which make only due allowance for differences in the cost of manufacture, sale, or delivery." It is significant that the law does not forbid the use of price differentials. It requires merely that they be justified by actual differences in costs of manufacture, sale, and delivery of goods under varying conditions.

The effect of the Act is to make necessary the determination not only of a basic cost of manufacture, but also of costs under various conditions such as in quantity lots as distinguished from smaller production requirements. The effective operation of the entire Act thus centers on the application of sound principles of cost accounting. The trend in taxation is toward greater recognition of cost accounting principles. Important Federal tax measures not only require the determination of costs, but even go so far as to prescribe specific rules of costing. With the Robinson-Patman Act, other important Federal statutes, and the trend in taxation, cost accounting is receiving increased tangible recognition as an instrumentality in the enforcement of measures of public policy.

While the task of cost standardization is beset with difficulties the fact remains that business has been compelled to recognize its cost problems not only from the standpoint of its own welfare, but also in relationship to other units in the same industry.

"Rugged individualism" in cost accounting is being superseded by the co-operative efforts of all units of a particular industry. To establish a comparable cost basis considerable uniformity in cost treatment is necessary. This means that the individual business may be compelled to relinquish some of its own ideas of cost determination so that it may comply with the standards and procedures established by the group of which it is a part.

This new recognition of the importance of cost accounting in the regulation of competitive practices has stimulated an unprecedented interest in the cost problems of all businesses, small as well as large. Business men who hitherto had neglected to realize the value of cost control and information in their organizations are now centering their attention on the cost department. For the professional cost accountant this situation holds much promise, as it emphasizes the vital significance of his work in our present-day economic and political structure.

It is of interest to note the statement of Col. Nelson B. Gaskill, formerly chairman of the Federal Trade Commission, relating to the effect of present-day problems on the work of the cost accountant:

"Your profession has before it as complicated, as important, and as large a task as now confronts the management of business itself. Your position in the great movement which dates from today is that of vital leadership. You are no longer relegated to the background to be called into action whenever business management finds the margin between its cost and whatever prices it has seen fit to make becomes too small. From now on your work will be a vital basis for price making, for selling policy, and for business control."

Simplicity an Essential Factor. It is important that cost systems be essentially simple. The author has investigated systems so befogged by meaningless forms calling for useless information that he was thoroly in accord with the disgust displayed by the management because of the absurd expenditure of time, money, and effort necessary to record facts which were never used.

Some cost system operations have become so congested with extraneous and superfluous matter that freedom of thought, action, or analysis is impossible. The systems themselves may be technically perfect, but so inflexible that the human element has no chance to function. In many cases they are so involved with complicated methods for planning, routing, machine efficiency, time and motion study, and general factory administration, that it is difficult to separate true cost accounting from mere attempts to record facts of factory control or management.

Cost Information an Aid to Management. Problems of factory management are administrative, and while it is true that an effective cost system should and does guide the policies of factory control, no cost system should be expected to be its own administrator.

The first mission of a cost system is to state the facts concerning expenditures incurred in production. Its second purpose is to coordinate these facts in order that policies for cost reduction may be carried out. The system must, however, present these facts and figures in such a way as to make possible a thoro analysis, otherwise worth-while cost reduction is not possible. Then too, it is only thru analysis of cost figures that effective factory planning systems, oper-

ating policies, personnel problems, wage and bonus systems can be intelligently approached.

The aim of the cost accountant should be to get at the truth about costs in the simplest way and then express it clearly. A fact presented alone may be readily understood, but if it is presented together with other facts, even tho in a certain way associated, its effect may be magnified or decreased. We are, therefore, going to present only the actual facts of cost accounting. No attempt will be made to solve every problem of factory management. We assume that executives are endowed with intelligence, that they are not entirely beyond redemption. We lay no claim to a patent on cost accounting.

The forms presented are merely suggestive. In all probability they will have to be changed to fit peculiarities in individual plants. They do contain, however, the essentials required of any cost system, and present facts in a manner that would logically lead to valuable analysis.

Cost Problems Exist in All Businesses. Experience in scores of business concerns proves that, while every department of a business has its cost problems, the real problem of cost control is in the factory. Not only is it in the production end of the business where production costs and operating expenses increase by geometrical progressions, but it is here where the business executive, anxious to check his rising costs, can attack his problems to the best advantage.

It is for this reason that we shall concern ourselves in this discussion only with cost accounting facts as they are reflected in the shop or factory. It must not

be assumed, however, that the proper organizing of a factory along so-called "scientific" lines of cost accounting, to the exclusion of all other departments, is recommended or even deemed advisable. The same thoroness and systematic analysis outlined for factory cost accounting in this discussion must be applied with equal force to fit the requirements of every department of a business, otherwise confusion will reign. To paraphrase Lincoln—"No business can permanently endure, half organized and half disorganized."

Relation to General Accounting. The most important factor in beginning the study of factory accounting is the relationship which this important division bears to general accounting. For cost accounting should not be considered as something entirely distinct from general accounting. It is, rather, a phase of general accounting, which requires specialization because of its importance and because of the specialized technique which it involves. The study of elementary and advanced general accounting is a prerequisite to the study of cost accounting. To point out the exact relationship of factory cost accounting to general accounting, we shall consider first the cost of sales section of the profit and loss statement of a trading business as illustrated below:

Beginning inventory of merchandise...	$000.00	
Add net purchases, including freight, cartage, insurance, etc.	000.00	
Total	$000.00	
Deduct current inventory of merchandise	000.00	
Cost of sales		$000.00

Then we shall see what changes will take place in

the cost of sales section if we assume that we are interested in a manufacturing business, rather than in a purely trading business. In this case, the cost of sales section may be reconstructed as follows:

Beginning inventory of finished goods	$000.00	
Add cost of production	000.00	
Total	$000.00	
Deduct current inventory of finished goods	000.00	
Cost of sales		$000.00

On first thought, the cost of sales section of the manufacturing business seems more simple than that of the purely trading concern. We have merely substituted inventories of finished goods for merchandise inventories and have used the term "cost of production" instead of "net purchases, including freight, cartage, insurance, etc." But back of the simple terms which we have substituted lies an entire major division of accounting—the division in which accounting principles are applied to determine the costs of production and the values of inventories of finished goods. The outlines of the cost of sales sections of the profit and loss statements show the point at which factory cost accounting comes into action and give us a key to its relationship to general accounting—a relationship which should be borne in mind throughout the entire discussion of cost accounting in this text.

In a trading business, the determination of cost of sales and the valuation of merchandise inventories is simple as compared with a manufacturing business. All necessary original data in a trading business can be obtained from purchase invoices and vouchers for the payment of freight, insurance, and other charges

on incoming merchandise. The difference in the case of a manufacturing business lies in the method by which the goods sold are acquired. Since the materials acquired are not in the form in which they are to be sold, it becomes necessary to apply accounting principles to determine the original material cost and, in addition, all costs involved in the process of converting the original material into the finished form in which it is sold.

That may involve any number of operations, from one or two to several hundred. It may include the proration of costs over thousands of articles going through the factory. It raises such questions as proper allowances for shrinkage, spoilage, and waste, consideration of the cost of machinery set-up, idle time, interest on money invested in the operating plant, the use of standard costs, over and unabsorbed burden, and the control of innumerable details, all of which must be reconciled with general ledger accounts. The problems of factory cost accounting are as complex and varied as industrial production and merit the special attention allotted to them in a general accounting training.

Factory cost accounting logically divides itself into:

1. Material Costs
2. Direct Labor Costs
3. Factory Overhead

A brief explanation of each of these elements will serve to lay the foundation for future discussion.

Material Cost. This represents the value of materials actually entering into and forming part of the finished product.

Direct Labor Cost. This is represented by the values expended for labor applied directly on the product in the process of manufacture.

Factory Overhead. Under this heading we have the values expended for factory overhead, that is, the values expended indirectly in production, which include those expenditures that are necessary but auxiliary to the material going directly into the product and the labor applied in processing it.

Factory overhead is sometimes termed "factory burden," "factory expense," "manufacturing expense," "oncost," or "indirect expense." It includes the expenditures or outlays for insurance, taxes, light, heat and power, factory repairs, machinery repairs, indirect labor, and factory supplies, as well as the exhaustion of certain fixed assets thru depreciation.

It should be noted that only actual expenditures are to be included in factory overhead, and that no consideration should be given to elements representing any anticipations of minimum earnings, such as interest on capital invested in a plant or rent returns where the plant is owned by the manufacturer. A man's possessions are not loans to himself, nor is a proprietor his own tenant. A discussion of this much-mooted question of interest on capital investment as a cost will be found in a later chapter.

Departmentalization

One of the most important factors in accurate cost accounting is to charge as many items of expense as possible to their final resting place in the accounts. A

well-regulated cost system will, consequently, require that the industrial plant be organized properly. This involves intelligent departmentalization.

Factors to Be Considered in Departmentalization. A department is a division of activity. It is seldom limited to four walls. The essential points to consider in departmentalizing a manufacturing plant are:

1. The manner in which responsibility will be assigned. This is necessary not only to produce accurate cost information from the viewpoint of the cost accountant, but also to aid the management in the proper control of production.

2. The nature and location of operations. The sequence of the direct labor operations will generally furnish the basis of establishing the departments in which work is performed directly on the product. The efficient routing of material thru the factory will indicate to a large extent the location of the operations altho the layout of the factory must also be considered.

3. The means afforded for the correct distribution of overhead and its application to the product. If a factory is intelligently departmentalized a sound foundation is provided for an adequate cost system because the various departments afford a convenient basis for the assembling of cost data. One big advantage of departmentalization is the fact that it provides for the calculation and application of departmental overhead rates. The departmental distribution of factory expenditures which have already been stated in this chapter will be treated in detail in a subsequent chapter.

Classes of Departments. The departments of a factory are generally classified as follows:

1. Producing departments
2. General departments

Producing departments are those divisions of activity in which the various processes of manufacture are performed directly on the material.

General departments which are sometimes called service departments are those which are not directly engaged in the manufacture of the product but which render services for the benefit of the producing departments. Consequently, the expenses of the service departments are a part of the factory overhead which must be absorbed in the factory cost of the products.

Figure 2 shown in the insert at the close of this chapter should be examined very carefully because it presents graphically the problem of departmentalization. It shows the relation of the storerooms to the producing departments. The producing departments are represented by:

Department 1. Machine Shop
Department 2. Subassembly
Department 3. Subassembly
Department 4. Final Assembly

The machine shop makes the individual parts. The subassembly departments put these parts together into units or subassemblies. The parts and subassemblies are assembled into the finished product in Department 4. The products move thru the factory in well defined lots. Their costs will, therefore, be best recorded thru the use of production orders.

Chapter II

THE DETERMINATION AND STATEMENT OF MATERIAL COST

Material costs cannot be determined accurately without a proper system of inventory control and material valuation. Such a system is not only necessary for proper material costing, but is of equal importance in purchasing and establishing material requirements. In order to discuss constructively the procedure for determining material costs, it is essential first to outline a proper method of stores control, purchasing, and stores valuation.

Control of Inventories. The storing of materials is a problem of efficient factory management, as well as one of physical arrangement and convenience. In small plants where all departments are under one roof, one storeroom centrally located may be adequate. In larger plants it is generally more practicable to have a number of storerooms, especially for materials that are used frequently in production.

In almost every instance materials should be kept under lock and key and readily accessible to the departments using them. They represent an outlay of cash. In fact, they are converted cash and should be accounted for as is the cash and currency in the cash drawer or the bank account. A manufacturer can no more afford to lose materials or products than he can

afford to lose actual money. Unless stores and finished products are safeguarded, losses thru spoilage, defective purchases, and theft cannot be accounted for.

Stores control, in order to be effective, must be both physical and clerical—physical thru actual mechanical protection of the stores themselves, and clerical thru the accounting records.

It has always been quite a quandary to the writer why otherwise well-informed business executives regard their inventories rather carelessly. Whenever an account is lost, or a shortage in cash is revealed, they generally want to know all the facts, but when an inventory adjustment of thousands of dollars must be made the matter is too often dismissed with a shoulder-shrug explanation, as tho such matters could not be avoided or controlled.

The Storeroom a Safety Deposit Vault. A storeroom should be a safety deposit vault for the funds which a manufacturer has invested in materials. Every stores clerk should be bonded and held responsible for the funds in his custody. He should at all times know exactly what he receives, what he disburses, and the balances he has on hand. Without such control and responsibility, effective cost accounting is impossible.

The experience of a manufacturer who attempted to make a comparison between the purchased castings forming a part of his finished product and the castings produced during the same period by his foundry, is of interest as an example of how not to control stores. His foundry had records of all castings on hand at the beginning of the period, of all castings produced, and

of those on hand at the end of the period. From these records it was possible to know the quantities used by the various departments. None had been returned to the foundry. No perpetual inventory was used to keep a running record of castings placed in stock, castings used, or balance on hand. No requisitions were made out when castings were wanted; the men simply helped themselves. When the manufacturer finally got the snarl untangled so that he could make some kind of a checkup, he found that several hundred castings could not be accounted for. The factory was located on a canal. An inspection of the bottom of the canal disclosed the castings—not only those unaccounted for during the period investigated, but a great many more. Altho this experience cost him thousands of dollars, the manufacturer turned it into profit by inaugurating a method by which he could physically and clerically control his stores.

Physical Arrangement of Stores. Experience in well-organized factories where effective cost systems prevail, demonstrates that small stores should be kept on shelves or in bins, and each article assigned a definite place in the storeroom. The shelves and bins, as well as the aisles, should be numbered or lettered, and each article given a symbol which will identify it and indicate its location in the storeroom. This symbol should be carried on the stores ledger sheet or card, so that the sheet or card will serve both as an accounting record and a guide to the exact location of materials. This makes it possible to sectionalize the stores ledger control over inventories, and maintain an effective general ledger control of the various sectional stores ledgers.

The Use of Symbols. To illustrate the application of symbols to stores, let us consider a storeroom with three aisles crossing three other aisles on both sides of which stores are kept. Figure 3 shows the floor layout of such a storeroom.

The layout shows the three main aisles as A, B, and C crossed by aisles 1, 2, and 3. The shelves are divided into groups known as A group, B group, and C group. If the stores kept in these groups are extensive they should be controlled by three stores clerks and by three stores ledgers. Each shelf should have a number of bins. The shelf numbers are important. The even numbers are at the right and the odd numbers at the

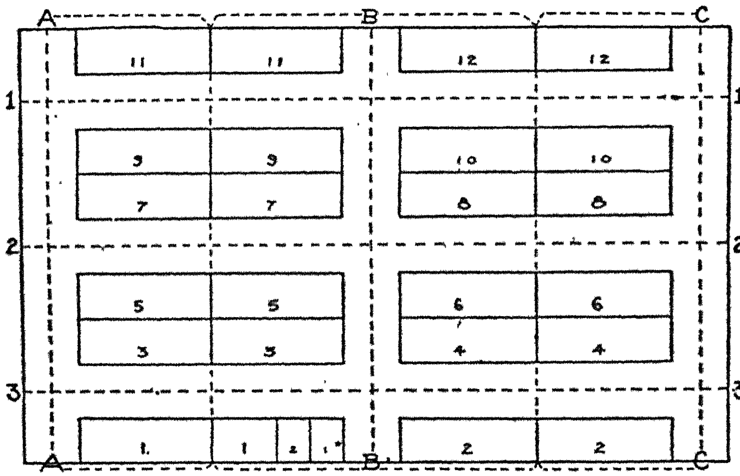

FIGURE 3.

left. As they are indexes to definite locations these shelf numbers should appear immediately after the aisle number. Stores kept in Bin 1, Shelf 1, Aisle B3, would be designated by the symbol B3S1-1 which should read "Aisle B3, Shelf 1, Bin 1" or the stores indicated by the check mark in the diagram.

Both the diagram and the discussion is merely suggestive—the plan may easily be changed to fit the requirement of any factory. For instance, aisle designations 1, 2, and 3 may be eliminated so that the symbol for stores in Bin 1, Shelf 1, Aisle B would appear as BS1-1 (Aisle B—Shelf 1—Bin 1). The stores in this location would be designated by that symbol in the stores ledger, in addition to the name, size, etc., of the stores. It may be advisable to also include a description of the stores on the bin or on the bin card.

The Proper Storing of Materials. No matter how large or how small the storeroom is or what quantities of materials may be carried, all materials should be physically classified so that materials of the same general class and nature may be stored together. In some plants it is often practical to divide all stores into different classes with each class under the control of a separate stores ledger and stores clerk. Such classification is of value in connection with the requisitioning of materials, as the foremen or workers will know exactly where certain materials may be obtained. The general ledger control over all inventories can then be split in the same way as split controlling accounts in cases where there are many accounts receivable. In this way discrepancies between general ledger control and the stores ledgers can readily be localized.

Where cards or loose-leaf records are used in stores accounting, they may be arranged so as to indicate the location of the stores. The symbols on bins or shelves should also appear on the ledger sheet or card with a description of the article. Sectional stores ledgers and sectionalized stores reduce errors in stores accounting,

because they fix responsibility and familiarize stores clerks with the various classes of material.

Stores Ledger for Clerical Control. The control of stores, especially in relation to buying and stores requirements, cannot be complete without proper stores records. These records must be in detail, so that discrepancies will be apparent. This is necessary, not only for material cost determination, but also for buying. Thus, for example, all sizes of round-head blue screws could not be kept on one card, because it would be impossible to determine from the record when a certain size had been used up. A section should be given to roundhead blue screws, and in that section a card should be devoted to each size. Such detail is, of course, also necessary for proper cost pricing.

It is not the intention to discuss at this point the valuation shown on the stores ledger sheets or cards, but merely to stress the fact that every sheet or card should bear the symbol of the article, the description, the location in the storeroom, a class index, and a maximum and minimum quantity index.

Index Serves as Warning. The maximum and minimum quantity index is the danger signal against overstocking or stock shortages, and should be compared with the balances on hand after every entry is made to a stores account. If buying is guided entirely by requirements as indicated by a maximum and minimum index, the fear of overstocking is eliminated as requisitions will be made on the purchasing department only when the minimum is threatened. The stores clerk should receive advance information of any unusual demands on his stores.

Under ordinary circumstances, all buying should be governed by the maximum stores requirements, altho variations from this procedure are entirely practical in cases where stores can be purchased at exceptional prices, even tho resulting in temporary overstocking.

Analyzing Your Material Requirements. The maximum and minimum stores index may be of even greater value than a mere danger signal to the stores clerk. If stores requirements are carefully analyzed, the index may be used to indicate the exact amount of material adequate, but never too great to secure a maximum turnover of each type of stores. Such an analysis must begin with an investigation of production and the proportioning of stores going into the product.

A great many manufacturers not only carry too great a quantity of stores, but fail to carry them in the proper proportion demanded by their production needs. Under such conditions maximum and minimum indexes, altho preventing overstocking or shortages, are little more than guesses.

Controlling the Maximum and Minimum Supply. The maximum and minimum index may be established thru a careful analysis of stock turnover, which must be determined in various ways for the different classes of stores, parts, or finished products. Everything being equal, it is, of course, advantageous to keep stocks as close to the minimum mark as possible, because the smaller the inventory the greater the turnover, with the added feature of a small capital tie-up. Whenever possible, the minimum and maximum indexes should be expressed in quantities rather than in terms of value, because values generally fluctuate.

To fix the minimum index for raw materials demands an analysis of the manufacturing requirements in connection with each class of material. A schedule indicating the relative quantities of production materials used in the past will furnish information as to the proper proportioning of raw material inventories. Such a schedule, combined with a study of deliveries, will indicate how much material of each class must be kept on hand to meet a production schedule for a certain period. For materials that are promptly received, a thirty-day supply may suffice, while for others, even tho no more are required to satisfy a certain production schedule, a sixty- or even ninety-day supply may have to be carried because deliveries are slow.

The quantities of finished parts and subassemblies to be carried in stock are determined by the requirements of final assembly, or if some finished parts are sold as parts, by the final assembly and sales. The manufacturing requirements of the parts and subassembly departments are the determining factors in fixing the raw material maximum and minimum indexes. The quantities of finished product to be carried in stock are fixed by the sales requirements, an analysis of which will indicate the turnovers and the proper balancing of the various types of finished product. The demands of the finished products stockrooms naturally fix the entire production programs upon which all other purchasing and departmental production are based.

Purchasing Requirements Based on Production. Generally speaking then, all maximum and minimum indexes are fixed by sales because they determine the production programs upon which all purchases for production depend. In fixing these indexes the work

must begin with an analysis of sales and finished product turnover. From such an analysis, production plans may be formulated, based either upon the already accomplished turnover, or upon an expected turnover. If a certain turnover is required, the quantity of stock to be carried must be fixed so as to secure the turnover demanded. Sales conditions influence turnover and inventory requirements because sales fluctuate. In cases where sales can be quite accurately forecasted and a certain turnover is required to insure a profit, the maximum inventory to be carried is that quantity which, when divided into the total sales, will equal the number of turnovers required.

Meaning of Turnover. The term turnover is used to indicate the number of times a definite quota of stock is completely sold out during a given period. This does not necessarily mean that the stock is ever actually exhausted, but that the sales have exhausted a certain quantity of stock a certain number of times during that period. To illustrate: if the average quantity of Article A carried in stock during a given year amounts to 10 units, and during that year 50 units were sold, the turnover would be 5 (50 divided by 10). Now, if these particular units should have a turnover of 10 in order to make their sale profitable, we may conclude (assuming that sales cannot be increased) that an average inventory of 10 units was excessive and that only 5 should have been carried in stock.

Again, if each of these units represented a cost of $1,000.00, the management might be open to criticism for having tied up $5,000.00 of its capital unnecessarily.

Determining the Rate of Turnover. For computing turnover some cost accountants suggest that the cost of goods sold (or quantities sold) be divided by the average inventory determined from the inventories at the beginning and the end of the year. This method is not advisable unless the two inventories present a true average for the entire year. In the majority of business concerns the beginning and end inventories, which are both really end-of-period inventories, represent the very lowest quantities of stores and stocks. If they are used, the turnover figure may be inordinately large and by no means reflect a true turnover.

A more effective method is to determine the average of the twelve monthly inventories of a year and use it, instead of the beginning and end of the year figures. If an average cannot be determined, because no perpetual inventory exists, the quantitative sales requirements for a certain period may be used in determining this average. There would be no constructive value in an average inventory based upon inventories taken at the beginning and end of the year. We might illustrate the inadequacy of such a method by assuming the following conditions:

METHOD I
Product A
(On Annual Basis)

Inventory Jan. 1, 1921	100
Inventory Dec. 31, 1921	110
Total	210
Average Inventory	105
Quantities sold during year	525
Turnover	5

METHOD II
Product A
(On Monthly Basis)

Jan. 1	100
Feb. 1	190
Mar. 1	200
Apr. 1	210
May 1	180
June 1	175
July 1	185
Aug. 1	190
Sept. 1	200
Oct. 1	190
Nov. 1	185
Dec. 1	175
Total	2,180

An analysis of these figures shows the following deductions:

Approximate error in Method 1..............2.1	Average inventory, Method 2 (Div. 12)..181⅔
Approximately true turnover 2.9	Quantities sold 525
	Turnover 2.9

From this comparison we see the error in using the beginning and end of the year inventories for turnover calculations. This error might be even greater in the case of large retail establishments where every effort is made to reduce such inventories to the very lowest figure, not only in order to reduce the time and expense of inventory taking, but in order to make room for seasonal stocks.

That the carrying of maximum and minimum quantities indexes is of great importance in securing the most profitable rate of turnover and in releasing working capital for profitable purposes, can be better understood from the following case: A retail furniture dealer located in a district where high-grade goods could not be sold, carried a stock of the highest grade of floor lamps. When the average number of lamps carried in stock was divided into the number sold during the year, it was found that there had been a turnover of one-half of one, when as a matter of fact the turnover should have been at least three. It was found that the sales of floor lamps could not be increased, so the stock to be carried was reduced by five-sixths. If sales continued as before, this average stock on hand would produce a turnover of three. By applying the same analysis to all his lines, the retailer discovered that he was carrying excesses, representing an invest-

ment of over $75,000. By establishing maximum quantities to be carried in each line, the proper turnover requirements were met, and the excess investment released for other purposes.

Purchasing Department. If purchasing is to be at all intelligent, it must be guided by material needs. These, in turn, are influenced by production programs. The purchasing department must function in conformity with storeroom needs as expressed by requisitions from the stores clerks. Where production is continuous, without changes in design or style of product, requisitions on the purchasing department from the stores department may embrace the entire procedure of supplying raw materials or finished parts (purchased on the outside) for manufacture.

Where special work is undertaken and the product varies from time to time, a bill of material drawn up and approved by the factory superintendent or works manager may be necessary before the stores department can make a requisition on the purchasing department. But in every case, a requisition by the stores department on the purchasing agent should be made so that a uniform procedure is established and maintained and proper responsibilities created. The requisition on the purchasing department should be in duplicate, one copy to be retained by the stores department, the other to go to the purchasing department. The form shown in Figure 4 is suggestive of how such a form should be made out.

Immediately upon receiving the purchase requisition, the purchasing department should order the materials and note the dates on which such orders are

placed, the vendor's name and the purchase order number. Copies of the purchase orders should be sent to the stores department so that it may have the necessary information for its records. The stores department will file its copy of the purchase requisition in an unfilled purchase requisition file. This file may serve

To the Purchasing Department: Purchase Requisition........

Please supply the following materials detailed below: Date................19...

Symbol	Description of Materials	Quantity	Date Required	Order Placed		
				Date	Order No.	Vendor

O. K.......................... Signed..........................

Purchasing Agent. Manager Stores Department.

FIGURE 4.

as a delivery tickler, if the requisitions are filed under the dates when the goods are needed. If the materials are received before the date set, the purchase requisition, with the date of receipt properly noted, may be removed from the unfilled purchase requisition file. Such a procedure will not necessitate needless search thru the files if the purchase order indicates the pur-

chase requisition number and the stores department will tab by purchase requisition numbers, under the date divisions of its files. A purchase order form such as shown in Figure 5 is suggested.

Purchase Requisition No........ Purchase Order No.........
For our own use only Date..............19.....

To..................................

....

Please ship the following goods via.................... and mark all packages as follows: "......................P. O. No................" Goods must reach us on or before..................192..... Please advise us immediately if delivery cannot be made as requested. We cannot pass your invoice for payment unless it indicates our purchase order number as above.

Quantity	Description of Materials Wanted	Unit Price	Value
	Invoices Must Be Rendered in Duplicate. Total		

Approved: Signed:

....
General Manager or Works Manager Purchasing Agent

FIGURE 5.

A purchase order, if accepted, becomes a contract and binds the vendor to deliver the goods ordered exactly as specified in the order. The order must contain all the information necessary to make it a binding contract. It should provide the vendor with all proper

specifications as to sizes, weights, qualities, quantities, prices, and instructions regarding dates of delivery, routing, packing, marking of packages, etc.

The purchase order as outlined should be made in quintuplicate, the copies to be distributed as follows:

1. To the supply house from which the goods are ordered.
2. To the accounting department.
3. To be retained by the purchasing department.
4. To the stores department.
   (The above four copies should be complete and show quantities, prices, and values.)
5. To the receiving clerk. (This copy should not show prices or values, but may or may not show quantities, all depending upon the character of help employed in the receiving department.)

Accounting Department Should Have Records of All Purchases. The accounting department should have copies of all purchase orders, so that it may make the necessary arrangements to pay all bills promptly. When the invoice is received, it should be attached to the copy of the purchase order and held until the receiving clerk's certificate reaches the accounting department. If the invoice must be paid at once to secure a discount, the paid invoice with the copy of the purchase order should be held in a separate paid voucher file awaiting the receiving certificate. The voucher will then be supported by the invoice itself, which, of course, must be checked as to prices, extensions, and quantities, and also by a copy of the purchase order and the receiving clerk's certificate. This certificate should indicate the storeroom or section to which the goods were delivered, and should bear the store clerk's receipt. In this way the purchase may readily be

charged to the proper stores ledger controlling account, if split stores controlling accounts are in use. In the event that goods are received on a purchase contract, the deliveries should be credited on the contract, a copy of which, like a purchase order, should be in the accounting department. After the balance to be delivered on the contract has been noted, a voucher supported by the invoice covering the partial shipment and the receiving clerk's certificate should be made out. Both supporting documents should be marked, "Received on Contract No.——."

Purchase Order Filed. A copy of the purchase order is retained by the purchasing department, and placed in an unfilled-order file under the date of specified delivery. This file can then be used as a follow-up tickler to check up on future deliveries.

Should the goods be received before the specified delivery date, the purchasing department will be informed by the receiving clerk. The receiving clerk's notice should show both the purchase order number and the purchase requisition number. It becomes a simple task then for the purchasing department to refer to the purchase order in the unfilled-order file. References need only be made to the purchase requisition which is filed numerically, because it will show the dates specified for delivery.

After the purchase order has been filled the purchasing department should file its copy in a filled-order file arranged numerically. If an alphabetical cross index is desired the copy of the purchase order originally sent to the receiving clerk may be turned over to the

purchasing department with a notation as to quantities received and quality of goods.

The Stores Clerk's Copy. The stores department should also have a copy of the purchase order so that it may follow up the purchasing department. After the order has been filled the copy should be filed in a filled-order file with the purchase requisition. The stores ledger clerk should immediately, upon receipt of stores, make the proper entries in his stores ledger. For the time being this should be for quantities only as prices may have changed since the order was placed. If values are to be indicated on the stores records (the author believes they should be) the correct amounts should be obtained from the approved invoice filed with the accounting department. If values are noted in the stores ledger, the vendor should be asked for duplicate invoices so that the duplicate, immediately after approval, may be sent to the stores ledger clerk who should, after proper entry, file them, either with the filled purchase orders and purchase requisitions, or use them in building up a file classified according to commodities, thereby providing an independent check upon his own store ledger distributions.

The Receiving Clerk's Copy. The receiving clerk should have a copy of the purchase order so as to facilitate the identification of stores received. The vendor should be instructed to mark all packages properly, and when possible include the purchase order number. In cases of carload shipments, the purchase order number should be indicated on the bill of lading.

As a safeguard against theft and carelessness, it has been recommended that the receiving clerk's copy of the purchase order should never show values, but may,

under proper circumstances, show quantities. It is contended by some that where values are shown and the articles ordered are not bulky, a dishonest clerk may be tempted to help himself. Also, where quantities are shown, some clerks may be influenced into the careless attitude of assuming that the goods received are of the specified quantity and quality without checking them up.

Under the plan outlined in this discussion a receipt is signed by the stores department for all goods put into the storeroom. This provides a check against dishonesty and carelessness. The stores department checks the count of the receiving clerk. As the stores clerk is bonded, and, consequently, responsible for his stores, the chances for dishonesty, collusion, and carelessness are reduced to a minimum. No banker receives a deposit on faith—he counts, inspects, and verifies the items before crediting his customer. Why not use the same procedure for the stores department?

In some cases the copy of the purchase order in the hands of the receiving clerk may serve as the receiving report; the receiving clerk, however, keeps a record of the goods received. Where copies of the purchase orders are used as a receiving report, such copies must be filled in by the receiving clerk and signed by the stores department when goods are received. The receiving clerk will then transmit his copy of the purchase order to the purchasing department which will, in turn, forward the copy to the accounting department where it will become part of the voucher.

It must, of course, be understood that no attempt is being made to outline a system of stores control which is applicable to all plants, but merely to describe plans

that have worked out successfully under the author's supervision. The method just described outlines the essentials around which to build a system for almost any size or type of manufacturing plant. In adapting it to fit one's needs, it should be remembered that whatever system of stores control is finally decided upon must contain some type of receiving form for the receiving clerk. Experience has demonstrated that such a report should be in triplicate in order to provide copies for the purchasing department, the stores department, and one for the receiving clerk.

It is also recommended that the receiving clerk's report number should always be marked on the purchase order copies so that a cross reference may exist, and also that the receiving clerk indicate the purchase number of all receipts entered on his receiving report.

Purchasing and Receiving Methods Summarized. It is essential from the cost accounting standpoint that purchasing and receiving methods be properly organized. The following points require consideration:

1. There should be definitely fixed authority to initiate requests of purchase of materials.
2. The request for purchase should be written on a prescribed form of purchase requisition to be forwarded to the purchasing department.
3. Each purchase requisition should state the specific object for which the proposed purchase is to be made showing the number of the account to be charged.
4. Orders to be placed with vendors should be issued on a prescribed purchase order form.
5. All goods received on a purchase order should be reported on a prescribed receiving report form.
6. The goods received on each production order should be reported separately.

7. All goods received should be properly inspected and reported to prevent the possibility of defective work arising in the manufacturing operations.
8. The stores methods should facilitate both physical and accounting control of inventories.

Chapter III

STORES VALUATION AND RECORDS

In addition to the invoice value of purchases there are, of course, other costs involved which must be taken into consideration in determining the value of stores. Freight is one item. The expense of maintaining the receiving, stores and purchase departments is another of the many, none of which may be considered as direct manufacturing costs, as they in no way affect the value of labor or factory overhead chargeable to product. They are expenses necessary and incident to giving a manufacturing value to materials purchased. In other words, they are the expenses necessary to bring the materials to the production point. They give added value to the material and must be considered as part of the inventory.

To illustrate this point, assume an independent warehouse located near a manufacturing plant and that the latter does not maintain a stores room. If the manufacturing plant purchased its materials from the concern operating the warehouse, it would have to pay the supply house not only the original cost of the material, but all the expenses incurred in getting this material into the warehouse, such as freight and hauling, storage charges, and a profit.

In order to save the profit which the manufacturer would be forced to pay to the warehouse, he decides

to store his own materials. In doing this he must assume the expense incident to buying, receiving, and storing. As in the case of purchasing from the warehouse, these expenses are then part of the purchase price or the manufacturing value of his materials.

Freight charges are cost items involved in giving materials manufacturing value. Many cost accountants who believe it is perfectly legitimate to add such charges to inventory value, contend that the cost of purchasing, receiving, and storing materials are cost items of another type and should be considered as general or factory overhead. If freight charges are a proper charge to inventory, why should not the additional expenses necessary to prepare and house the stores for manufacturing purposes be just as proper a charge? Whatever expenditures add value to commodities (such as those incurred by the warehouse) become part of the cost of these commodities and should be added to the invoice value.

Establishing Overhead Rate for Material. To merely say that a thing should be done does not tell one how to do it. How then shall the expenditures made in connection with purchasing, receiving, and storing be charged to the inventories in both the general books of control and in the stores ledgers themselves? In the case of a proposed cost system installation, the answer would depend upon whether or not the concern makes some of its own parts to be used in further assembly. If it does, the procedure will be different than if all parts and all raw materials were purchased from the outside. We will discuss the procedure in both cases, by using an illustration in which the expenses for

material are the same. Let us consider the following conditions:

1.	PURCHASING DEPARTMENT SALARIES		$10,000.00
2.	PORTION OF OFFICE OVERHEAD CHARGEABLE TO PURCHASING DEPARTMENT:		
	2a. Portion insurance	$100.00	
	2b. Portion taxes	50.00	
	2c. Portion depreciation	50.00	
	2d. Estimated office supplies	100.00	
	2e. Estimated telephone, telegraph, and postage	400.00	
	2f. Market reports, etc.	50.00	
	2g. Miscellaneous pro rated	250.00	1,000.00
3.	RECEIVING DEPARTMENT WAGES (including unloading)		5,000.00
4.	RECEIVING DEPARTMENT MAINTENANCE CHARGES:		
	4a. Insurance	$200.00	
	4b. Taxes	100.00	
	4c. Depreciation	200.00	
	4d. Estimated repairs	100.00	
	4e. Supplies and miscellaneous	200.00	
	4f. Light, heat, and power (if any)	200.00	1,000.00
5.	COST OF TRANSFERRING FROM RECEIVING DEPARTMENT TO STORES ROOMS		2,000.00
6.	STORES DEPARTMENT SALARIES AND WAGES		5,000.00
7.	STORES ROOMS MAINTENANCE CHARGES:		
	7a. Insurance	$400.00	
	7b. Taxes	200.00	
	7c. Depreciation	400.00	
	7d. Estimated repairs	200.00	
	7e. Supplies and miscellaneous	400.00	
	7f. Light, heat, and power	400.00	2,000.00

8. Estimated insurance and taxes on average values of stores carried....	$ 3,000.00
9. All miscellaneous items..............	1,000.00
Total Material Expense.............	$30,000.00
10. Total invoices amount to............	$3,000,000.00

It is assumed that the entire time of the purchasing department is devoted to purchasing for manufacturing needs, that all purchasing of office supplies is the function of the office manager, and that the value of invoices covering purchases for the factory amounts to approximately $3,000,000.00, not including freight; also that the purchases are such that the freight can be charged to the various commodities purchased and to inventory controlling accounts in the general books, and that the materials purchased present no appreciable variations in bulk to their relative values.

Case I. All Materials and Parts Used Are Purchased. It is apparent from the illustration that the material expenses represent 1 per cent of purchases entered in the records by the manufacturing concern. (Invoices are $3,000,000.00 and material expense amounts to $30,000.00.) If purchasing remains normal 1 per cent added to the value of every invoice posted in the general books and stores ledger accounts would in time meet the annual needs as well as any requirements brought about by seasonal buying. For example, it would be unfair to charge each month's actual material expense to that month's purchase invoices, because such a plan would result in charging too much to inventories during some months and not enough during others. In fact, a condition might arise in which no invoice appears during one month, or where practically

all invoices would be entered during a period of a few months, as in the case of seasonal buying. The addition of a fixed percentage to invoices actually entered, no matter how distributed thruout the year, would eliminate the difficulty presented irrespective of the actual monthly expenditures for material overhead. To illustrate: A concern's purchase invoices amount to $1,200,000.00 for the year, and the entire material burden amounts to $12,000.00, which is 1 per cent of the invoices. The invoices are received and entered as follows:

January	$400,000.00
February	200,000.00
March	100,000.00
April, May, June, July, and August	None
September	100,000.00
October	150,000.00
November	200,000.00
December	50,000.00
	$1,200,000.00

The actual material burden expenditures amount to $12,000.00, or $1,000.00 per month. A procedure of distributing $1,000.00 to the $400,000.00 January invoices, and the same amount to the $200,000.00 February invoices, or to the invoices of the other months could not be justified. All sorts of irregularities would result. It should be remembered that the material burden becomes inventoriable, not when the expenditure is made, but when the commodities are actually placed in the storeroom or represented by accepted invoices properly recorded; in fact some goods may be in transit. In other words, the charge for material

burden should not, in fact, cannot, be added to the actual material or inventory cost until such materials are on hand. Obviously, the entire burden must be equitably distributed over all the stores purchased with that expenditure. The expenditure exists, not for any one month or for any certain batch of materials, but for the entire year and the entire additions to inventory thru purchases.

Where all materials and parts for manufacture are purchased, the accounting procedure is quite simple. For every invoice entered in the stores ledger accounts, one per cent is added for inventory or material burden. The form and method of making such additions will be outlined in detail when the stores ledger sheet is discussed.

Entries in the General Books. On the general books such as the purchase record or voucher register, it is, of course, unnecessary to add the percentage to every invoice—in fact that could not be done, since the addition is not a payable item and must therefore be journalized. The entry should be made monthly on the basis of the total value of invoices recorded. For example, in January when the invoices amounted to $400,000.00, the journal entry would be:

Inventories....................$4,000.00
  To reserve for Inventory Burden......$4,000.00

In this way a reserve is created against which will be charged the actual expenditures for inventory burden. Some of the charges will come thru the journal and others thru the voucher register.

The journal entry charging inventories, being based upon the total invoices for a month, should agree with

the individual charges to the various stores ledger accounts, because the whole of anything is equal to the sum of all its parts. This entry not only does not disturb the general ledger control over a perpetual inventory, but produces that very agreement for which controlling accounts are useful. To state the proposition another way—the $4,000.00 charged as one amount to the controlling account, is also charged in numerous amounts, totaling $4,000.00, to all the different stores accounts contained in the stores ledgers.

Case II. Where Some Parts Are Made by the Manufacturer. When a manufacturer produces in his own plant some of the parts which are to be finally assembled in the finished product, it is at once apparent that some inventory expense is already included in the total cost of these parts, since they were made from other materials purchased, to which the percentage of overhead is applicable. But once made, these parts take their place alongside other parts purchased. They do not go to a finished-product storeroom or warehouse, but to a storeroom from which they will be withdrawn later. They are, therefore, subject to some carrying and handling charges.

From the same illustration used in Case I, let us assume that instead of purchasing $3,000,000.00 of materials and parts, only $2,500,000.00 are purchased, and that $500,000.00 represents the cost of manufactured parts to be used in assembly. Our distribution of material burden of $30,000.00 would then assume a different character because a division would have to be made of those charges applicable to both purchased and manufactured parts. It must be borne in mind that the $500,000.00 cost of manufactured parts in-

cludes some inventory overhead chargeable against the $2,500,000.00 purchases. After tabulation the result will be as follows:

Expenses Entirely Applicable to Parts Purchased		Expenses Applicable to Parts Purchased and Parts Manufactured	
Purch. dept. salaries	$10,000.00	Stores dept. salaries	$5,000.00
Purch. dept. overhead	1,000.00	Storeroom maintenance charges	2,000.00
Rec'g dept. wages	5,000.00	Ins'nce on stores	3,000.00
Rec'g dept. maintenance	1,000.00		
Cost of transferring from rec'g dept. to stores	2,000.00		
Miscellaneous	1,000.00		
	$20,000.00		$10,000.00

The value of parts made is $500,000.00, or 16⅔ per cent of the entire value of $3,000,000.00; therefore, 16⅔ per cent of $10,000.00, or $1,666.67 representing expenses relating to storage alone, should be allocated to the inventory values or cost values of manufactured parts stored: The total expense of $30,000.00 would be distributed as follows:

On $500,000.00 of manufactured parts	$ 1,666.67
On $2,500,000.00 of purchased parts	28,333.33
Total expense to be distributed	$30,000.00

This means that to every purchase entered in the stores ledger, 1.13⅓ per cent would have to be added, and that to the manufactured parts put into stores .33⅓ per cent would have to be added. This procedure indicates the course to be followed no matter what the proportion of parts manufactured to be stored bears to other parts purchased.

Weight Determines Freight Cost. In-freight on specific articles should, as a rule, be charged directly to those articles. In cases where the freight charges are billed for a mixed shipment, it may be impracticable to tabulate the weight of the various items and prorate the charges, even tho weight and not value is the basis for freight cost allocation. If freight cost cannot be applied to separate incoming units as they are placed in stores some general but fair application of this inventory cost must be made. Various plans for accomplishing this are in use, but it is the author's opinion that any plan to give accurate results should be based upon weight considerations.

As commodities for the storeroom are shipped from various places, freight rates will vary. If these fine distinctions are to be observed, it may be necessary to prorate the charges on each incoming shipment separately, so that the right rate may be applied. This may mean varying rates even in the same class of stores, because shipments of one class may come from different points.

A practical method of basing the charges on a weight basis is to fix an average rate for each class. This rate must, of course, be based upon weight, but may be translated into terms of percentage to average value when finally applied. For example, if a rate is

$0.20 per 100 pounds and the cost per 100 pounds is $20.00, then the addition of 1 per cent to the value would absorb the freight. Such a plan will naturally create a different accounting procedure than that previously discussed.

In cases where it was recommended that freight charges be added directly to each stores account and to the controlling account for inventories in the general ledger, it was assumed that the charges could be definitely applied to specific articles. But where this cannot be done, and the freight must be estimated on each class of stores by the use of average percentages, the stores department must keep a record of the amounts added for freight. This record should indicate the total value added each month on stores placed in the storerooms. The following general journal entry should be made:

Inventories.............. $......
    To Reserve for Freight........ $......

As the freight bills are actually vouchered for payment, the charge thru the voucher register will be to the Reserve for Freight Account.

The charging of a flat percentage to all purchases and to each invoice, in order to bring into inventory costs the material burden for purchasing, storing, insurance, taxes, etc., assumes that the value of purchases is a fair basis by which to measure the material burden applicable to the purchases. This may or may not be true. There are cases where bulky materials are relatively cheap, while other materials of practically no bulk are extremely valuable. By adding a percentage to value of both types the material that oc-

cupies little storeroom space would be burdened with entirely too much storeroom expense. In such cases, the expense of purchasing might still be related to the purchases on a value basis, but the expenses of operating the storerooms should be prorated on the basis of space occupied.

By using a combination of both plans, a value rate may be fixed for the different types of materials in the same way as in the case of freight charges where it was found practical to fix a value rate on the basis of the weight rate. If, for example, $500.00 represented the purchasing department overhead in purchasing $10,000.00 worth of Material A, while the stores department also incurred an expense of $500.00 for handling the material, which is a great deal more than it would cost to handle the same amount of material of a much greater value, then an addition of 10 per cent to the purchase price would cover both purchasing and storing charges.

The purchasing department in most plants does not confine its activities only to purchasing materials for manufacturing purposes. Purchases must be made for the general office, for the repair department, and very often for the factory itself (machinery, tools, furniture, fixtures, and office appliances). In such cases an arbitrary division of purchasing department expense must be made so that the approximately correct amount may be included in the charge for inventory burden. A similar division may in some cases have to be made in the receiving department.

Only after a careful study of the expenses connected with purchasing and storing, and of the materials

stored in relation to their space utilization, can one determine on the most feasible plan of inventory burden application in any particular case. It cannot be too strongly emphasized that in many plants different burden rates must exist for each general class of materials.

Providing Forms for Controlling Stores. Another problem is the matter of proper forms for the stores ledgers and the general controlling accounts. While stores ledger sheets or cards vary in different industries, Figure 6 is recommended for the average manufacturing plant where freight charges may be applied against each commodity received:

STORES LEDGER

Commodity, A — Location: — Maximum, 600
Symbol, XY23 — Section, B — Minimum, 100
Pattern No..... — Bin 24,

Purchase Requisition					Received						Disbursed		Balance
			Order Placed										
No.	Date	Quantity	Date	P.O. No.	Date	Invoice Value	Freight	Inventory Expense	Total Value	Quantity	Req. No.	Quantity	Quantity Only
1	1/3/20	200	1/5/20	6	1/10/20	$200.00	$ 5.00	$ 2.00	$207.00	200	55	50	150

FIGURE 6.

This form contains provision for purchase requisitions, adequate description of commodities as to location, symbol, and maximum and minimum quantities, and provides for complete information regarding values, including in the latter, freight charges and inventory expense. In filling out the form we have as-

sumed the inventory expense to be 1 per cent of the invoice value. When this form is first placed in use, that is, after inventory taking, only the "total value" and "balance" columns need be used. Only quantities are provided for in the "Disbursed" and "Balance" columns. This is ample for all ordinary cases. Values need not be shown on every withdrawal, nor for the balance on hand unless the values of the commodities fluctuate considerably. In cases where the values fluctuate, it may be advisable to value each disbursement on the basis of actual value of stores on hand, disbursing the oldest stores first. Such a plan really presupposes that each withdrawal comes out of a certain lot specially priced.

Altho quantity balances should be extended after each disbursement, it is usually not necessary to value balances or withdrawals except on the basis of average unit cost as fixed at the beginning of each month. To illustrate:

The receipts for one month are as follows:

Date	Invoice Value	Freight	Inventory Expense	Total Value	Quantity
1/10	$200.00	$5.00	$2.000	$207.000	200
1/15	201.50	5.02	2.015	208.535	200
1/25	200.80	5.00	2.008	207.808	200
	$602.30	$15.02	$6.023	$623.343	600

Total Value, $623.343 ÷ 600 = $1.038905, unit cost

If no stores were withdrawn during January, the stores requisitioned in February would be valued at $1.038905 per unit. Or, if there was no balance at the

beginning of January and stores were withdrawn in January, these withdrawals would also be valued at $1.038905. Simplicity demands a fixed unit price to be used for each month, and for that reason the stores ledger clerks should ascertain at the beginning of each month the unit values to be used in valuing requisitions for the succeeding month.

Let us assume the following February transactions:

February receipts, 200 units valued at $207.65.

February disbursements, 400 units valued at a unit price of $1.038905. The stores ledger entries at the end of February would be as shown in Figure 7.

Received						Disbursed		Balance Quantity Only	
Date	Invoice Value	Frt.	Inventory Exp.	Total Value	Quantity-	Req. No.	Quantity	Unit Value	Quantity Bal.
Feb. 1				$623.343	600			$1.038905	600
Feb. 10	$200.60	$5.05	$2.00	207.65	200				800
						101	50		750
						122	40		710
						167	100		610
						192	210	Fwd.	400
				$830.993	800		400		
Deduct	Feb. Wi	thdra	wls	415.562	400				
Mar. B	alance i	n Sto	re	$415.431	400			1.0385775	400

FIGURE 7. Stores Ledger Entries

The unit price as of February 1 was used on all the disbursements for the month of February as indicated by the deduction of $415.562. After this deduction the

stores remaining are refigured by dividing the value of the remainder ($415.431) by the units (400) still on hand, thus fixing a new unit cost ($1.0385775) to be used for the March requisitions or withdrawals.

The requisitions are priced individually on the basis of the unit cost. This pricing may be done by the cost department clerks or by the stores ledger clerks before sending the requisitions to the cost department. This leads up to a consideration of stores accounting control or supervision.

Controlling Stores Ledgers. Stores accounting and stores valuations are the bases of proper material costs. For that reason it is often advisable to place the control of stores ledgers with the cost accounting department. Whether the stores ledgers are to be kept by the stores clerks or by clerks directly under the supervision of the cost accountant are questions which depend largely upon the nature and size of the plant. In some plants it may be necessary and practicable to have the stores clerk keep the stores ledgers. In other plants where storekeepers are kept busy receiving and distributing stores, they should not be loaded down with bookkeeping work. In that case it may be necessary to transfer the bookkeeping work to some other department. In fact, such a plan is very desirable because it provides an independent check on the stores clerks. Materials in the storerooms are on shelves, in racks, in bins, in drawers, or in separate compartments, and each bin, drawer, etc., is provided with a card indicating quantities on hand. The stores clerk should enter on this card all materials received or disbursed. The quantities shown on bin cards should

agree with the accounts in the stores ledgers. A simple form of bin card is shown in Figure 8.

Article........................ Size......................

Symbol........................ Location..................

Date	Quantities		
	Received	Disbursed	Balance

FIGURE 8. Bin Card

In some cases it may be more practicable to note the requisition number on the bin card than to indicate the date on which the material was disbursed, because in that case it may be easier to trace differences between stores ledger and bin-card balances.

Material Requisition. Requisitioning for materials and stores used to replenish supplies in the stores rooms, i. e. purchase requisitions, have no direct relation to cost accounting. We are interested in requisitions which call for stores for production purposes, because as stated in the introduction, our entire discussion of cost accounting procedure is limited to the plan of determining the cost by production orders. The values shown on these stores requisitions become charges to production orders.

A production order is an order issued to the factory to produce a certain quantity of parts or finished products. A bill of material which includes a list of all materials necessary to fill the order is generally issued in connection with such an order. The bill of material should never be used as a requisition on the stores department, but should serve only as a statement of stores needed to fill the order. On the basis of a bill of

Requisition No......... MATERIAL REQUISITION Production Order No........

Department No........ Date............19......

Symbol	Detailed Description	Quantity	Unit Price	Total Value	Remarks
	TOTAL				Materials Recd. O. K..........

Requisition Filled	Entered Stores Ledger	Entered Material Cost Records	Signed
.... Stores Clerk.	.... Ledger Clerk.	.... Cost Dept.	.... Foreman. Dept.....

FIGURE 9. Material Requisition

material the stores department should at once determine whether ample stores are available or whether additional stores must be purchased.

All requisitions for stores used on production orders should be in triplicate. The form shown in Figure 9 provides the necessary information.

Origin of Requisition. Requisitions originate with the foreman who keeps the triplicate for his own protection. The party receiving the materials will receipt for them in the space provided on the original. Original and duplicate, after they have been signed by the stores clerk filling the requisition, will go to the stores ledger clerk unless the stores ledger clerks also perform the duties of the stores clerks. This is particularly true in the case of smaller plants. The stores ledger clerk should note on both the original and duplicate, the unit price and total value of each class of materials withdrawn, and post as a credit the total quantities withdrawn to the various stores ledger accounts. The stores clerk should retain the duplicate and file it numerically by months under the requisition number. The original goes to the cost department which also keeps a material cost sheet for each production order. After entry of each requisition on the proper material cost sheet, the cost department files the requisitions under production orders. This provides a cross index of the stores ledger clerk's file arranged by requisition numbers and the cost department's file arranged by production orders.

Values of withdrawals should be determined at the end of each month from the stores ledger clerk's monthly file of requisitions on which values are extended whenever requisitions are entered. These total values must in turn agree with the total distribution of values by production orders as tabulated in the cost department.

Figure 10 shown on the insert at the end of this chapter summarizes graphically the procedure set forth in this chapter. Start at the top and follow the heavy line down to the bottom. The steps are numbered consecutively from the time the request for the purchase is made until the voucher for the purchase is recorded in the voucher register and is posted to the Raw Material Controlling Account. The lines directed to the various forms are numbered to correspond with the steps to which they belong.

FIGURE 10

Summary of Accounting Procedure
Purchasing and Receiving
Raw Material

Chapter IV

THE MATERIAL COST SHEET

Before taking up the question of assembling material cost figures, it is necessary to fully understand the nature and purposes of production orders. They are of various types, and may call, either for the manufacture of a finished product ready for sale, or for the making of parts or subassemblies for storage. As a general rule production orders should be issued so that costs may be ascertained frequently, which means that they should call for quantities that provide for a relatively short period of production. Such a procedure should in no way retard production nor require much additional work in the cost department.

Classes of Production Orders. Production orders, are generally classified as follows:

1. Parts Production Orders
2. Subassembly Production Orders
3. Final Assembly Production Orders

There are, in addition, various types of repair orders on which materials may be used and to which other costs may be applied, and construction orders for plant additions, tool production, the making of jigs and dies, etc. Repair orders will be discussed in connection with factory overhead. Construction orders need not be discussed here because they do not enter into the cost of manufacturing a product. It should, however, be remembered that the cost department must consider

all types of costs in reconciling the total labor expenditures.

The requirements for the three classes of production orders depend upon the conditions of manufacture. In some plants all parts entering into a finished product are purchased, so that parts production orders are not needed. Other plants make their own parts, and the parts go immediately into final assembly. Such plants use parts and final assembly production orders. Other plants may subassemble parts before final assembly. If they also make parts, all three classes of production orders will be used.

The manufacturing procedure will determine the type of orders to be used and the subdivision of inventory accounts and control. A plant using all three types of orders will have, in addition to the Raw Materials Inventory Account, inventory accounts for finished parts, subassemblies, and finished product. These subdivisions may not be necessary in the general ledger inventory controls. In some cases where parts and subassemblies do not go into storage, it may not be necessary to use more than the final assembly production orders, but wherever parts or subassemblies are produced for storage, separate orders are called for and separate inventory accounts and general ledger control is advisable. In line production, as, for example, in automobile manufacture, the various storerooms for parts and subassemblies can be located along the line immediately adjacent to the assembly work requiring these parts or subassemblies.

In a machine shop or job plant a job number is generally used instead of a production order. In a

large manufacturing plant, the parts production order is similar to the job order of a small job plant. In fact, the individual departments of a large factory are very much like job shops, each department specializing in the manufacture of certain parts only, these parts in turn going into a Parts Inventory Account and parts storeroom for final assembly.

Preparing Production Orders. Production orders must be in writing. Whenever necessary they should be in detail, giving a complete schedule of departments involved, subproduction orders to be issued, bill of materials, routing, etc.; or they may be very simple, merely stating that a certain number of parts, subassemblies, or finished commodities are to be produced or assembled. In the latter case, the duty of furnishing the routing of the order, the production planning, the making of a bill of material, is left to the works manager, who, thru his production, planning, and routing departments will be held responsible for the entire procedure. He must issue whatever written instructions or orders are necessary. A production order for a finished product will generally require the issuing of parts production orders, subassembly orders, a bill of material to the stores departments, and orders to all the foremen of the manufacturing departments involved. Copies of all production orders must, of course, go to the cost department, and such general departments as may become active in the production of the goods. The planning department should have a copy, because special tools may be needed, certain machines must be put in order, and entirely new manufacturing supplies may have to be purchased, and it is that department's duty to look after such details.

Issuing Production Orders. Production orders should be issued, either from the general office by the general manager, in coöperation with the sales department, or by the works manager, if the production is for stock rather than for specific sales contracts. Naturally, all production orders should be based upon sales requirements or possibilities, either general or specific.

MATERIAL COST SHEET

Article:
Symbol, CS — P. P. O. No., 131
No., 24 — Foreman: — Quantity, 50
Estimated Material Cost $...... .... Dept., 1
Entered Master Cost Sheet.............Cost Dept.

Requisition No.	Material A			Material B			Material C			Material D			Total Material Cost	
	Quantity	Value		Quantity	Value		Quantity	Value		Quantity	Value			
221	300	$130	00	40	$20	00				20		40	$150	40
239	120	52	00	12	6	00	20	$5	00				63	00
260	200	86	67	10	5	00	30	7	50	30		60	99	77
Total	620	$268	67	62	$31	00	50	$12	50	50	$1	00	$313	17
Unit of Material and Cost	12.4	$ 5	37	1.24	$ 0	62	1	$ 0	25	1	$ 0	02	$ 6	26
Standard	600	260	00	60	30	00	50	12	50	50	1	00	303	50
Standard Unit Mat'l and Cost	12	5	20	1.2		60	1		25	1		02	6	07
Unit Variation from Standard	4		17	.04		02								19

FIGURE 11.

It is therefore important that the production schedules based upon sales requirements be carefully and frequently scrutinized so that the production orders may follow the schedule very closely.

When the copies of the production orders are received by the cost department, then material cost sheets, direct labor cost sheets, the factory overhead sheets, and the master cost sheets for each order number must be placed with the various cost clerks who are concerned with these various cost tabulations. These sheets should be distributed to the various departmental divisions of the cost department—the material cost sheets to the material cost clerk, the direct labor cost sheets to the labor cost clerk, and so on.

Material Cost Sheet. In order to fully understand material cost tabulations, let us assume that a plant is making its own parts (including castings), and that a parts production order has been issued in Department 1 for the manufacture of fifty parts. The part symbol and number is CS-24 and the parts production order, No. 131. The form shown in Figure 11 will provide adequate information as to material costs:

It will be noted that the form has been filled in by entering all the requisitions by number, in sufficient quantities to complete the fifty parts called for. In checking up on the costs we find that the following materials were used to complete the order:

620 units of Material A valued at	$268.67
62 units of Material B valued at	31.00
50 units of Material C valued at	12.50
50 units of Material D valued at	1.00
A total Material Cost of	$313.17

A Comparison with Standard Costs. The per unit cost for the 50 parts completed is $6.26. We find upon inspection, however, that the total cost should have been $303.50, and the unit cost $6.07, and that the ex-

cess of $9.67 may be accounted for by variations from the standard in Materials A and B. In other words, 20 units more than standard of Material A were used, and two more than standard of Material B. But what have standards to do with cost accounting and, in this particular case, with material costs?

Every part manufactured and every subassembly or product made may be reduced to a formula which lists all the material necessary for the completion of every part of the finished product. In other words, to make 50 units of Part CS, No. 24 (Figure 11) should require no more than 600 units of Material A, 60 units of Material B, 50 units of Material C, and 50 units of Material D, the units representing any convenient form of measurement—pounds, gross, dozens, or distinct units. The material formula, therefore, for one Part CS, No .24 is A12, B1.2, C1, D1. This represents all the necessary material to make the part.

A standard is then the exact quantity of material necessary to make a part. Variations from the standard are either avoidable or unavoidable. For this reason an investigation should be made so that the exact reasons for the variations may be definitely known. The need of tracing these variations has given rise to the detailed material cost sheet by production orders illustrated in Figure 11.

Fixing Responsibility. After the variation from standard material requirements has been traced, one can readily fix responsibility. For instance in the case illustrated in Figure 11 there was an excess of 20 units of Material A used, and apparently it was called for in requisition No. 239. This was signed by a certain fore-

man, possibly the same foreman who signed all the other requisitions. The natural inference is that the foreman could give an explanation. His explanation will probably indicate spoiled material and the worker responsible for it. Was the spoilage avoidable or unavoidable? Was the worker solely at fault or was the material defective? In either event a remedy exists—the worker can be cautioned or penalized, or the vendor of the defective material held responsible. From investigations of this kind, real material requirement standards for any production may be created. Such investigations, however, are not possible unless a material cost sheet such as shown in Figure 11 is used.

It will not do to merely assemble material costs by filing requisitions under a given production order. True, such a procedure will give the actual costs of materials used, but there will be no analysis into classes of material, nor will it be possible to tabulate actual results against standards, unless such a comparison be actually made. A permanent record must exist in order that future comparisons of production orders may be made with actual results as well as against standards. It is also for this reason that a material cost sheet should never be on the same form with direct labor costs or factory overhead. An adequate form containing all these cost elements would be too unwieldy. It is far better to assemble these elements finally on a master cost sheet, a form which will be discussed later.

How the Material Cost Sheet Is Filled in. The initials P. P. O. on the material cost sheet indicates parts production order. The blank space opposite "Estimated Material Costs" is to be filled in by the

foreman of the department before the production order is started, so that some approximation as to probable material cost may be had in advance. There is a special value to such estimates in connection with entirely new production, when accompanied with like estimates for labor cost and factory overhead. Placing this responsibility up to the foreman not only makes him alert, but furnishes the factory management with a clue as to his knowledge of the operating conditions of his department. After the order has been completed, a check can be made against the estimates, revealing the foreman's understanding of his duties. The material cost sheet will also show any allowances the foreman may make for unavoidable spoilage or waste, which in turn may be compared with actual results when the order has been completed. If such estimates are called for on all new production orders, certain information is established which a manufacturer may use to advantage, if he is called upon to make a price on special orders in advance of actual production. The value of estimates on regular production may not be so great, but will, nevertheless, train a foreman along lines of accuracy and knowledge of his own departmental operations.

An organization having a well developed production department would not, of course, expect the departmental foreman to make estimates. Our discussion has in mind the average factory where the foreman often acts as production manager.

Separate Columns for Materials. These columns are valuable in that they make it possible, by comparison with past orders, to ascertain the standard quantities necessary to make certain parts, and to estimate the

normal waste and spoilage. In this way a properly balanced inventory may be established. The "Value" subcolumn under "Material A" or "Material B," is filled in by the cost department from the unit value of the materials as indicated in the stores ledger and on the requisition. This unit value is the one current during the month the requisitions are made, and the same requisitions are entered in the stores account as credits. The unit value then, multiplied by the number of units charged under the proper material heading on the material cost sheet will indicate the total value of the requisitions.

Both the unit and the total value of a requisition may vary from month to month, all depending upon changes in unit costs of materials as reflected in the stores ledger accounts. The grand total of units charged under the various material columns, when divided into the grand total values in these same columns, would merely give the per unit cost indicated for the month in the stores account. If the production order was in process for more than a month, any variation in unit value would also be indicated. In that case there would be no particular value in arriving at the per unit costs of the stores or material units used in the order.

Unit Material Cost. Under the designation, "Unit Material Cost," we have information which is of considerable value. This unit cost does not refer to the total units of materials drawn into production, but to the cost per unit obtained by dividing the total value of each class of material used by the number of finished parts, which in this case amounts to 50. Thus, by dividing $268.67 (total value of Material A) by 50,

we know that for each of the 50 finished parts, $5.37 worth of Material A was used. The same results can thus be obtained for all materials used in the order.

If material values do not fluctuate widely, this form provides another basis for estimating costs in advance of production. It should be remembered that a composite value basis must sometimes be used rather than a commodity unit basis.

If Material A represented a dozen or more kinds of small hardware, we could not expect an analysis of this material in detail, even tho credits to stores accounts might be individual. It would be satisfactory in most cases to designate Material A as small hardware and determine the total value only. But we would know that the per unit cost of the finished part for small hardware was $5.37, and we could with fairly accurate knowledge, estimate the cost of small hardware on similar future parts production orders.

Then again, the actual results may be compared with standard figures which can be arrived at by a detailed analysis of quantities and values required, no matter how numerous the various classes of materials may be.

If material values are fairly constant we can establish periodical per unit value standards—thus:

Material A	=	$5.37
Material B	=	.62
Material C	=	.25
Material D	=	.02
		$6.26

These figures represent actual material costs per unit. The itemized figures, when compared with established standard costs, will show where variations have crept in.

Value of Material Cost Sheet. The real value of the material cost sheet is, however, not in determining the values of the materials used, because that comes as a matter of course, but rather in noting the relation of quantities used, to the standard quantity requirements. The value per unit of material used is fixed and total values will rise or fall as quantities rise or fall. The comparison made between quantities actually used and quantities which should be used to finish the order is of prime importance. The quantity columns of the material cost sheet designated as "Standard" are the yardstick with which to make this comparison, because, while the value column will vary from month to month as prices of materials fluctuate the quantities will remain the same. The values will automatically take care of themselves, altho they must be fully considered in connection with cost tabulation or in fixing a selling price.

The standard requirements to make 50 parts of CS, No. 24 are 600 units of Material A, 60 units of Material B, 50 units of Material C, and 50 units of Material D. This standard may be either an absolute one, showing the exact quantities necessary on a strictly formula basis, or it may be a modified standard which allows for normal or unavoidable wastage or spoilage. It should not be overlooked that in certain industries, unavoidable shrinkages will occur. In order to get a certain result, more materials must be used than indicated by a purely mathematical equation. For example, in the manufacture of dairy feeds, the weight of the final product, resulting from the grinding and mixing of batches of various ingredients, is not equal to the total weight of the original ingredients; there is an actual

loss in grinding, as well as a loss in weight thru moisture evaporation. Wherever possible, wastage should be salvaged for by-products or sold as scrap.

Standard Unit Material and Cost. Under the designation, "Standard Unit Material and Cost," is listed the number and value of units required of each class of material necessary to make one unit of the parts called for. By reference to the stores ledger accounts, we can at any time determine what the total material cost of a single part would be, and note any fluctuations in the market price of material. This eliminates guesswork and makes it possible to know in advance the cost of materials for contemplated orders.

Unit Variation from Standard. The heading on the material cost sheet "Unit Variation from Standard" shows at once the excess quantities of materials of each class used to make one of the parts called for, as well as the excess value of each class of material used in one of the 50 units. To illustrate: the excess quantity of Material A used in producing each part, CS, No. 24 was .4. Since 50 parts were made the entire excess was 50 x .4 or 20, which is the difference between the total of 620 and the standard of 600. The value excess for each of the 50 units is $0.1735 which amount multiplied by 50 ($8.67) indicates the difference between the total value of Material A actually used ($268.67) and the standard of $260.00.

Subassembly Production Orders

Subassembly production orders do not vary materially from parts production orders, altho they call for an assembly of parts rather than an assembly of raw materials. When parts are finished, they go into

FIGURE 12

Chart for Assembling Industry Showing How a Product Receives Its Cost Values

a parts stores room or section and the units received are entered in the proper stores ledger in which the number of the parts production order will appear.

The material cost sheet for subassembly production orders will have the same general appearance as the one suggested for parts, but instead of dealing with material columns most of the columns will be headed by the parts numbers or symbols and the totals will indicate the number of parts of each kind used in the subassembly. It should not be concluded, however, that no material columns should appear, because even in subassembling and in final assembly, raw materials may also be drawn directly into production.

Final Assembly Production Orders

The material cost sheet for final assembly orders will be similar to the parts material cost sheet, altho the columns corresponding to the materials columns in the parts sheet will probably be headed so as to indicate parts used, subassemblies used, and possibly raw materials, as combinations of all three classes may be necessary to assemble the finished product.

Reference to Figure 12 will show how manufactured parts are delivered to the manufactured parts storeroom, on completed production orders. As the parts are requested for subassembling, the costs of these parts are charged to a material cost sheet for a subassembly production order. When the subassemblies are completed, they are delivered to the subassembly storeroom to be requisitioned on final assembly production orders.

We wish to reiterate that parts and subassemblies may not all be made within the plant. They may

either be made or purchased in a finished state. The only effect of such a procedure will be reflected in the stores ledgers, the debits coming either from purchase orders or completed production orders. Credits will be thru requisitions charged to either subassembly production orders or final assembly production orders, the requisitions themselves indicating to which class of order the withdrawals apply. There may also be credits to these various stores ledger accounts for parts or subassemblies sold and, of course, all credits to inventory account for finished products will generally be for sales. It should also be remembered that some credits may be made to raw materials stores accounts for materials used in the factory on repair or construction orders, and to parts and subassembly stores accounts for repair parts furnished customers gratis because of guaranties.

Materials withdrawn on requisition when not used or only partly used must be returned to the storerooms and the account readjusted. This is generally handled thru a material credit slip on which the production order is credited and the Stores Account is charged; the credit slip should finally be attached to the material requisition on which the goods were originally ordered out.

For the time being we will pass from the material cost sheet to a consideration of direct labor costs. The material cost sheet will, with others showing direct labor costs and factory overhead, be disposed of when all costs are assembled on a master cost sheet.

Procedure for Consumption of Raw Material. Figure 13, shown in the insert, presents graphically the procedure described in this chapter from the time the

material is delivered from the storeroom and recorded on the Stores Ledger accounts until the summary of all material issued for the month is credited to Raw Material Control Account in the general ledger. The corresponding debit is made to Production Orders in Process Control Account. The balance in the Raw Material Controlling Account should represent the aggregate balances of all stores ledger accounts for the various kinds of raw material carried in the storeroom. The charge to Production Orders in Process Controlling Account is the sum of all charges for raw materials to the material cost sheets on all production orders on which work was done during the month.

Accounting for Workmen's Time. Direct labor can be readily accounted for. The time clocks, which record the "time in" and "time out," furnish the general control for all labor time. Such clocks should be installed in each department and should furnish a check on the detailed time records prepared within the factory. Both records should, of course, always be checked against each other when the pay rolls are compiled.

Each departmental pay roll can be made up from the workers' cards used in the general time recorder, as they are generally the basis for labor payment, unless some special arrangement exists for accounting for lost time. The pay roll should be prepared by a timekeeper under the control of the cost department. He should separate the pay roll into the various types of costs: direct labor on product, indirect labor in connection with production, construction labor, and repair labor.

Distribution of Labor Charges. The daily individual time report will make it possible to distribute the labor costs as suggested. This report may be made out by the worker himself, or by the timekeeper. The worker's daily time report should, of course, indicate the worker's name, his number, and his department. The body of the report should show the production order, the operation, the machine number, the time started, the time finished, lost time, total time, number of pieces finished, the cost, and the cost per piece.

In many cases it is not advisable for workers to make out their own time cards; time is lost this way, and there is always a tendency toward inaccuracy. In

factories where departmentalization has been perfected, there is a timekeeper in each production department. He not only accounts for all the working hours of employes, but very often enters on the time report the time when operations are to be started. Very often he also prepares a working schedule for employes, in which case he may be called a dispatch clerk. He should also calculate the elapsed time and send the labor reports to the pay-roll department daily. From a cost accounting standpoint, the importance of reporting labor time accurately cannot be overemphasized. An adequate timekeeping department is absolutely essential in getting correct cost information.

The form shown in Figure 14 illustrates a typical daily time report.

As direct labor is the only labor cost chargeable directly to product, this form should be used only to record this type of labor. Lost time may or may not be charged to a production order. If it is idle time made necessary because no task was assigned, it may not rightfully be charged against any order; if it represents lost time occasioned by unavoidable delays, such as the changing of tools, setting up of new machinery, reconditioning tools or the like, the lost time may properly be charged against the production order responsible. In any event, it should be recorded separately so that the causes may be traced. Some cost accountants contend that setting-up time, altho chargeable to a production order, should be shown in the lost-time column in order to know exactly what time was required to set up the machines. This helps in establishing a minimum time basis for this work.

In the form it will be noted that the lost time is not charged to a production order, but as lost time. Such entries on the time card should lead at once to an investigation to find out the reasons and prevent their recurrence.

Form of Time Reports Varies. The form is, of course, merely suggestive. In some plants, cards to be

DAILY TIME REPORT

Dept. 1 Laborer's, No. 16

Date, March 17, 19 Name: James Swift

Production Order	Operation	Machine No.	Time Started	Time Finished	Total Time Hours	Rate	Total Cost	No. Pieces	Cost Per Piece	Lost Time Hrs.	Lost Time Value
P131	1	3	8:00	12:00	4	$0.75	$3 000	50	$0.06		
P172	1	3	1:00	4:00	3	.75	2 250	25	.09		
P172	2	4	4:00	4:30	½	.75	375	25	.015		
Lost Time			4:30	5:00		.75				½	$0.375
TOTALS					7½	$0.75	$5 625			½	$0.375
Lost Time Added to Productive Time					½		$0 375	O. K. by			
Total Labor Cost for Day					8		$6 000	.... Time Keeper			

Entered Cost Department	Entered Pay Roll Department	Approved:
Date......19...... By......	Date......19...... By....	.... Foreman

FIGURE 14.

used with punch clocks may be more convenient. Whatever system is used the cards should indicate the production order, the operation, the machine number, the time started, and the time finished. In cases where the employe works continuously at the same machine and performs the same operation, the machine number and operation may be printed.

Under some conditions it may be found advisable to have a separate time report for each production order, especially where there are only a few production orders. Where jobs are numerous and the time required on each is short, the collective report showing the time spent on all the jobs has some advantages. Reports of this type make the work of assembling the labor costs easier, especially if mechanical tabulation is used. The time reports may be conveniently filed or classified by production orders and the compilation of the labor cost figures thus facilitated.

Where separate time reports are made up for each production order, it may be advisable to have separate reports for lost or idle time. These reports should give full information as to the causes of lost time, so that it will not be necessary to consult the foreman or the worker for an explanation, except in special cases.

In any form that is used, the production order number, the operation, the machine number, and the pieces produced should be shown. Provision should also be made for the total cost of each operation per production order and the cost per piece. From this information a time study can also be made, as the per piece time unit can be determined by dividing the total time by the number of pieces. Later, it will be explained how this information is also of value in comparing the production of different workers on the same or similar operations.

The worker's daily time card should have the timekeeper's approval before it is turned over to the payroll clerks. He should also insert the rate, the total time, the total cost, the cost per piece, and all other in-

formation necessary to make out the pay roll, including a record of the time lost. After the card is approved by the foreman it should go to the pay-roll department for the distribution of the time to the departmental direct, indirect, repair, or construction labor accounts, and for the allocation of charges for lost time. If the lost time is unavoidable, a record will assist in establishing an amount which may be considered as part of departmental normal overhead.

Transfers between Departments. When workmen are transferred to some other department, the timekeeper or foreman should issue a transfer order indicating the worker's name and number, the department to which he is regularly assigned, the department to which transferred, together with the reason and authorization and whether or not there is to be a change in rate of pay. A copy of this order should go to the pay-roll department at the time of the transfer so that the departmental pay-roll records will be adjusted. It may not be necessary to send copies to the cost accounting department, because the worker's time reports will always indicate the department in which he has been at work.

Checking Employes' Time Reports. The pay-roll department must use the individual daily time reports because the cards coming from the general time recorder give no clue to the distribution of time. The total distribution of time by jobs must agree with the total time of the general time recorder. If variations are disclosed the foreman must first approve them before the worker is paid for time as shown by the general time recorder. Such a procedure is a safe-

guard against padding. In turn, the pay-roll department distribution will afford a check on the total direct

Dept. 1		PAY ROLL																Half Month Ending March 31, 19				
Kind of Work Laborer		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total Hours	Rate	Amt.		Paid by Check No.
No.	Name	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31					
									Direct													
1	Tom Jones		8	8	8	8	8	8		8	8	8	8	8	8		8	104	$1 00	$104	00	
2	Jack Frost		8	8	8	8	8	8		8	8	8	8	8	8		8	104	.90	93	60	
3	Sam Howe		8	8	7	8	8	8		8	7½	8	8	7½	8		6	100	.50	50	00	
																		308		$247	60	
									Indirect													
3	Sam Howe																2	2	$0 50	$ 1	00	
10	Fred Johnson		8	8	8	8	8	8		8	8	8	8	8	8		8	104	1.25	130	00	
11	R. Davis		8	8	8	8	8	7		8	8	8	8	8	8		8	103	.60	61	80	
																		209		$192	80	
								Repairs														
18	Chas. Banks		8	8	6	8	8	4		8	8	8	8				6	80	$0.90	$ 72	00	
								Construction														
18	Chas. Banks				2			4						8	8		2	24	$0.90	$ 21	60	
20	J. Carpenter		8	[illegible]	8	8	7	8		8	8	8	8	7	8		8	102	1.00	102	00	
																		126		$123	60	
								Lost Time														
3	Sam Howe				1					½				½				2	$0 50	$ 1	00	
11	R. Davis							1										1	.60		60	
20	J. Carpenter						1							1				2	1.00	2	00	
																		5		$ 3	60	
Total Carried to Summary Pay Roll																		728		$639	60	

Time and Rates Checked	Entered Summary Pay Roll Sheet	Approved:
.... Timekeeper	....	.... Foreman

FIGURE 15.

labor allocated to production orders by the cost department.

Forms used to record indirect labor, repair labor, and construction labor should be printed on cards of different colors so that they may be easily dis-

tinguished. The workers should be listed on the pay-roll sheet according to their numbers so that the time of workers performing both direct and indirect labor can be readily accounted for. Figure 15 is typical of pay-roll sheets used in many factories.

When the workers' daily time cards or reports have been entered on the pay-roll form, they will at once be sent to the cost department where they should be analyzed by production orders, departments, and operations. The time report has a space for the pay-roll department's check.

After the pay-roll sheet has been approved by the foreman, it should be sent to the paymaster, who will issue the checks or prepare the pay envelopes. The next step is to enter it on a summary pay-roll sheet from which the entries in the general books of account will be made. A pay-roll summary is shown in Figure 16.

The pay-roll summary must be thoroly checked in the pay-roll department as to distribution, as well as hours and labor costs. After approval by the pay-roll department, it should go to the voucher clerk who will prepare the necessary voucher for entry in the voucher register. The detailed distribution on the voucher register will be discussed later, in connection with the general and total reconcilation of the general books with the factory costs. After entry on the voucher form, the pay-roll summary will be forwarded to the cost department, the latter reconciling the hours and costs with the total distribution of hours and costs by production orders.

By comparing the laborer's daily time reports it is possible for the foreman to judge the relative production possibilities of the individual workers—and weed out the inefficient.

PAY ROLL SUMMARY

All Departments. Half Month Ending March 31, 19

Dept.	Direct			Indirect			Repairs			Construction			Lost Time			Total		
	Hrs.	Amt.		Hrs.	Amt.		Hrs.	Amt.		Hrs.	Amt.		Hrs.	Amt.		Hrs.	Amt.	
1	308	$247	60	209	$192	80	80	$ 72	00	126	$123	60	5	$ 3	60	728	$639	60
2	400	360	00	100	95	00	10	8	00	20	19	00	1		90	531	482	90
3	650	590	00	150	140	00	25	20	00	10	9	00	2	2	00	837	761	00
4	900	800	00	200	180	00	15	13	00	....	....	..	....	...	..	1115	993	00
Total	2258	$ 1997	60	659	$ 607	80	130	$ 113	00	156	$ 151	60	8	$ 6	50	3211	$ 2876	50

Checked:	Entered:	Approved:
.... Cost Department.	.... Voucher Clerk.	.... Pay Roll Dept.

FIGURE 16.

The departmental pay-roll sheet will show the total lost time and by whom lost. In cases where the lost time is unavoidable, it may be considered as a direct charge to profit and loss on the general books, as a charge to an account for lost time, or as part of factory overhead for which a reserve may be created. Where a reserve is created, the lost time should be charged against it as it occurs. Construction labor may be charged directly to the appropriate capital account thru the pay-roll voucher, or to the proper account as shown on the construction order filed with the cost department. If the latter method is used, the voucher clerk will charge the construction labor to construction

orders in progress. This procedure may also be applied to repair labor—the voucher may indicate a charge to repair orders in progress, or if a reserve for repairs account is set aside the charge may be directly to this reserve.

Preventing Lost Time. An analysis of the departmental pay-roll sheet will suggest the proper division of the working force so that workers performing direct labor will not be called upon to function as repair, construction, or indirect workers, except in unusual cases. The proper flow of materials, correct planning and routing, adequate power, proper tools, wages and bonus plans; efficient ventilation, heat and light and scores of other factors, while not included in the functions of the cost system are nevertheless indispensable to the successful operation of any cost system. While each may present a different problem, the solutions all have the same end in mind—better production methods and the reduction of production costs. They must all be worked out with that end in mind. While they may be matters of factory administration rather than of cost accounting, they are so closely associated with cost accounting that any solution of them without the close co-operation of the cost department will in all probability result in failure.

The wage system is one of the most important of these factors. For that reason a special chapter is devoted entirely to a discussion of this subject.

Chapter VI

DETERMINING DIRECT LABOR COSTS

Where production orders come thru a number of departments, the cost figures should show the production order by departments. If a routing order accompanies the production order, the daily entries on the cost records should be made so that they will indicate the progress of the work, in the order indicated by the routing sheet. Parts production orders are generally completed in one department, but subassembly and final assembly orders may go thru numerous departments, so that the direct labor cost tabulation will be somewhat enlarged.

Direct Labor Cost Sheet

The form shown in Figure 17 will take care of the tabulation of direct labor costs for parts production orders, assuming that the orders are completed in one department:

Should the operations be numerous, it may be found advisable to rearrange the form so that the operation numbers and the worker's numbers will read up and down the sheet, instead of across; or, if a loose-leaf book is used, insert sheets may be provided to list the operations. As all production orders are divided into three classes—parts, subassemblies, and final assemblies, and the cost department handles each order separately, it is not probable that any single order will pass thru an unusual number of operations. Direct

Sequence of Operations		Name of Part		Symbol CS24	Estimated Cost $	DIRECT LABOR COST SHEET						P. P. O. No. 131	Dept. 1	No. of Parts 50	
Dept.	No.	Date	Worker's No.	Operation 1			Operation 2			Operation 3			Operation 4		
				Hrs.	Value	No. Pieces	Hrs.	Value	No. Pieces	Hrs.	Value	No. Pieces	Hrs.	Value	No. Pieces
1	1	3/17	16	4	$3.00	50									
	3	3/17	8							4	$3.50	50			
	4	3/18	10										4	$4.00	50
	2	3/18	5				4	$ 4.00	5						
		3/19	5				4	4.00	5						
		3/19	6				8	8.00	11						
		3/19	7				8	8.00	15						
		3/20	7				8	8.00	14						
Totals				4	$3.00	50	32	$32.00	50	4	$3.50	50	4	$4.00	50
Per Unit Cost of Operation				.080	$ .0600		.64	$ .64		.08	$ .07		.08	$ .08	
Per Standard Unit Cost of Operation				.078	.0585		.60	.60		.08	.07		.08	.08	
Variations from Standard				.002	.0015		.04	.04			None			None	

Labor Cost Summary	Standard	Actual	Variation
Hours	41.9	44	2.1
Total Cost	$40.425	$42.50	$2.075
Unit Cost	$ .8085	$ .85	$ .0415

Entered on Master Cost Sheet

By..
Cost Department

FIGURE 17. DIRECT-LABOR COST SHEET.

labor costs are posted to the form shown in Figure 17, from the workers' daily time report shown in Figure 14. A comparison of the two forms will show how the postings are made.

Testing Labor Efficiency

A cost system is of value only to the extent that it will reduce costs and increase production. For that reason a direct labor cost sheet should contain information which will show the performances of labor and all variations from the established standard. The operations in each department must be shown together with the production of each individual worker on each operation, in order to make comparisons possible.

By referring to the form shown in Figure 17, it is obvious that worker No. 6 is more efficient than No. 5, and that No. 7 is a better worker than No. 6. Such a comparison may not only suggest the advisability of a special investigation to determine the reasons for variations, but it may also demonstrate that certain workers should specialize on operations in which they show the greatest proficiency. The direct labor cost sheet shows clearly the order of operations. As shown in Figure 17, Operations 1 and 3 are performed on March 17. Operation 4 follows, because the entire 50 pieces had to be worked on in Operation 4 before Operation 2 could be performed. Operation 2, performed on March 18, was the last operation, as indicated by the fact that no other operations are reported after that date. By rearranging the form so that the operations are listed up and down, instead of across the sheet, the entries may be made to conform with

the sequence of operations regardless of whether the orders pass thru more than one department.

After all the direct labor charges have been entered, the total hours and total costs should be noted in the space provided. Total hours, value, and total number of pieces worked on in each operation are entered at the foot of each operation column. The number of pieces worked in each operation do not necessarily agree with the number of parts called for by the parts production order. For example, in Operation 1, there might have been 100 or 200 pieces instead of 50. These may have appeared in other operations until finally a certain operation combined them into the 50 parts called for in the order, or into subparts, later assembled into the 50 parts covered by the parts production order.

If many workers are employed in the various operations, a form providing for the dates and the workers' numbers, in connection with each operation, may be used. Such a form would merely prefix the headings—"dates," and "worker's No." before each "operation" column. Separate sheets or cards might also be used for each operation, each bearing the production order number, the department number, the number of finished parts called for, and the name or symbol of the part being produced. After the order is completed, the individual operations sheets or cards should be summarized so as to give all information shown on the direct labor cost sheet in Figure 17.

Labor Costs by Operations. Just as the various columns in the material cost sheet provide a formula of the materials required for a production order, so the

operation columns of the direct labor cost sheet furnish a formula of the labor hours and labor costs required to complete an order. It is just as necessary to know what the minimum hours and labor costs should be as it is to know the standard quantities of materials necessary. For that reason, standards of labor performances, expressed in both hours and costs, should be determined from the direct labor cost sheet so that a check up is possible on workers who use more than the standard time.

The form shown in Figure 17 shows variations from standard labor costs by totals and by operation. If we consider Operation 2, it is apparent that the entire time of all operatives, based upon the standard, should have been 30 hours and the per piece time 36 minutes. Worker No. 7 did better than standard, because on the first day he produced on the basis of one piece every 32 minutes, saving 4 minutes on each piece, or a total of one hour; on the second day he produced one piece every $34\frac{2}{7}$ minutes, saving $1\frac{5}{7}$ minutes on each piece, or a total of 24 minutes. This saving was cut down by workers No. 5 and 6, who dropped below the standard 2 hours and 1 hour, 24 minutes, respectively. Comparisons such as these demonstrate how cost data can be made the very essence of standardization.

Subassembly and final assembly orders often pass thru a number of departments. A larger form of direct labor cost sheet along the line of the one suggested in Figure 18 should be provided for these orders.

In studying the forms supplementing this discussion, it must be borne in mind that the forms are merely suggestive and filled in only for the purpose of showing

the operations of the form and for convenience in following the discussion. Few, if any of them, can be used successfully without making some changes to fit the special requirements of each different factory. For instance, in the form just described, the same operation numbers were used for all departments. Separate sheets for each department or for each operation within a department may be found necessary. If, however, the number of operations and the number of departments involved are more or less like those shown on this form, the latter should prove adequate. The cost accountant is the best judge of his own requirements and should work out his own adjustments from the accepted procedure as outlined in the forms presented. Whatever adjustments or rearrangements are made, however, provision should be made for summarizing the total cost on each production order on a separate analytical form such as the one suggested.

To eliminate clerical work some cost accountants would recommend the filing of the worker's daily time reports by production order numbers with subfiling by departments and operations. This plan would, of course, require a separate daily time report for each production order, devised in such a way that the labor time of each department and operation could be conveniently arranged in the file.

In some cases this may be satisfactory, but mere filing does not lead to analysis and may produce the opposite effect. If an analysis is to be made, a form similar to Figure 18 must eventually be prepared from the cost files. If this analysis is made daily, many weaknesses in operations may be discovered and corrected before the work is finished. Not only must cost

information keep up with production, but the habit of making daily entries on analytical forms develops the power of analysis, which is a powerful factor in devising better production methods.

Calculation of Unit Costs. The unit time and unit cost of each operation is not figured on the basis of the number of pieces worked on in an operation, but upon the number of parts, subassemblies, or final assemblies completed.

Comparison of Labor Performances. A further analysis of the direct labor cost sheet will reveal information that is valuable when time and motion studies are made. In the first place, each worker's performance in quantities on a given operation is shown. As a result, a comparison of the production of a number of workmen performing the same operation will indicate their relative speed and efficiency.

Recording Lost Time. Lost time which cannot be charged to a production order should be recorded on the worker's daily time report and considered by the cost department, either as part of departmental factory overhead, or reported as a direct charge to the Profit and Loss Account. A suitable form for keeping track of lost time is shown in Figure 19.

The worker or the foreman should be able to furnish a reason for all lost time, which should be investigated by the cost department and the result noted on the form. The form will show the total time lost yearly, and the percentage of lost time to the departmental direct labor hours and the direct labor pay roll; it will also show the average number of hours lost per

Dept. Foreman: LOST TIME RECORD Dept..........

....

Year 19....		Worker's Name	Worker's No.	Lost Time		Reasons Given	Inspected By
Month	Date			Hrs.	Value		
Total for Year						% of Direct Labor Hours	
Average per Laborer................ Hours						% of Direct Labor Pay Roll	

FIGURE 19. LOST TIME RECORD.

laborer. This information will be serviceable in establishing the amount of lost time which must be considered as part of departmental overhead.

Construction and Maintenance Labor. The cost department must also keep records of construction and repair costs and of indirect labor. The materials used on such orders must be tabulated and proper overhead charges applied. In considering indirect labor, only such indirect labor auxiliary to production will be dis-

cussed. The labor of repair men, construction men, and workers employed in connection with the generation and transmission of power, will be considered in connection with factory overhead and construction orders. As indirect labor (auxiliary to direct labor and production) is a part of factory overhead, its distribution will be considered in our discussion of factory expenses.

The tabulation of construction and repair orders costs should, in a general way, follow the procedure recommended for regular production orders. When this is done, the same analysis of results are possible and the costs of repairs and construction may be reduced to a minimum. Altho indirect labor does not work on production directly, it should nevertheless be as carefully analyzed and standardized as the direct costs. For instance, if a trucker reports the number of loads hauled, the pieces carried, distances covered, etc., an investigation of his activities may demonstrate whether or not it would be profitable to install mechanical conveyors, or a different type of truck, or suggest some other improvement. It is common knowledge that indirect labor shows more lost time than direct labor.

Indirect workers, who daily perform work that can be reduced to definite units, should make out daily reports on special forms provided for that purpose and designed to make close supervision by the foreman possible. Such forms should indicate the department number, the worker's name and number, the kind of work performed, the time spent on each task, and whatever unit of measure is found appropriate. In most plants it is impractical to have every form of in-

direct labor subjected to daily time reporting. Sweepers and janitors could hardly be expected to make detailed daily time reports. The largest item of indirect labor is supervision by the plant superintendent and the departmental foremen. The superintendent transmits his orders and the manufacturing policies of the industry thru the foremen. He is held directly responsible for the entire personal factors in factory operations. He must also see to it that the mechanical features of the plant are in prime condition so that they will not slow up production.

Altho both superintendent and foremen give considerable time to general factory conditions, their chief activities consist in maintaining maximum production thru proper control of labor's activities.

Summary of Accounting Procedure for Direct Labor Costs

The procedure described in this and the previous chapter is summarized in Figure 20. The labor time is accounted for from the time the laborer rings his time on the clock until it is charged as direct labor on the direct labor cost sheet of the production order on which work is expended. It is also shown how the pay-roll summary is recorded in the voucher register and is posted to Production Orders in Process Controlling Account for all direct labor, and how the salaries and wages arising in the general departments, the indirect labor and repair labor are charged to Factory Expense Account rather than to Production Orders in Process. The reason for this procedure will be apparent after the subject of factory overhead has been treated.

FIGURE 20

Summary of Accounting Procedure for Direct Labor Costs

Chapter VII

THE DEPARTMENTAL APPLICATION OF FACTORY OVERHEAD

Factory overhead consists of all indirect expense necessary to operate, maintain, protect, and keep intact the plant and the investment. Such expenses are either shown by actual disbursements or by the exhaustion of the plant and plant equipment. They are expressed by either purchase vouchers or journal entries to record adjustments for exhaustion of assets and expense accruals. Expense arising outside of manufacturing operations should not be included, such as selling and administrative expenses, which have nothing to do with the manufacture of the product. They are expenses incurred in marketing the product and in administering the general affairs of the business.

While cost accountants agree quite generally on what constitutes the elements of factory overhead, they are divided on the methods of distributing factory overhead to the product. Various theories have resulted from this division of opinion. Some points of view are so broad that they have practically no limits, while others are so deep and involved that they have no bottom on which to base a workable program. Many of the difficulties have been overrated, some have been approached from the wrong angle, and still others have been misunderstood. Cost accounting implies facts and accurate analysis. If accurate analysis is applied to the actual facts and cost figures as they are revealed by efficient cost accounting procedure, the correct

method of distributing factory overhead should not present serious difficulty.

Factory overhead consists of the following expense elements: Indirect labor, superintendence, light, heat, power, taxes, insurance, depreciation, building and machinery repairs, manufacturing supplies, and the expense of operating general factory departments. Where the plant is leased, factory rent should also be included. There may be other items in certain cases, but the classification given here covers the usual list.

Factors Involved in Overhead Rates. In the modern plant we will find quite frequently that processes are intricate and complex and that homogeneous operations are limited to small areas. The machines and equipment vary considerably as to value, operating capacity, and the nature of the work to be performed. For this reason each machine affords a natural unit for the allocation of overhead expense. Consequently, where production is dependent primarily on machines, machine rates should be used in distributing a portion of the factory overhead. In departments where production is dependent, not upon machines, but upon labor, labor-hour rates of overhead should be established for the various production centers. There will be developed in this procedure two factors in establishing overhead rates:

1. General factory overhead to be applied to the cost of production orders on the basis of direct labor hours.
2. Machine expense to be absorbed thru a predetermined machine-hour rate.

Predetermined Rates. Overhead rates are often computed in advance of actual incurrence of overhead

expenses. Whenever the production-order method of ascertaining costs is used, overhead rates are predetermined in advance of a fiscal period. If actual overhead were used, the cost of the products completed before the end of the month could not be ascertained until the close of the month, because the overhead rates must be calculated at that time. It would be quite a task to use actual expenditures each month to fix a monthly rate, and it would mean the holding up of all production orders until the end of each month before the rate could be applied in determining the total factory cost.

In many industries, the volume of business is seasonal so that there will be variations in the expenses of one month compared with those of another month. In the clothing industry, for example, a large percentage of the business is concentrated in a very few months. It is obvious that if goods were costed with current actual overhead expenses, the cost of the goods would differ materially according to the period of the year in which the costs were ascertained, due to the variations in overhead rates. Price policies cannot be maintained under such conditions, nor can there be a proper control of manufacturing expenditures. There must be some basis of overcoming such a condition and at the same time assuring the inclusion in costs of every dollar expended. The manner in which this is done is quite simple if it is once understood.

The factory expenses over the same period may be studied thru the course of several years, and a budget of overhead expense for each department may be prepared and considered as standard. These standard overhead charges for an ensuing fiscal period may be

distributed over different work places, or production centers, which may be workbenches, machines, groups of like machines, or assembly places. Then these expenses may be studied in relation to the normal working time of each department or production center and normal overhead rates established. In order to have prompt compilation and presentation of unit costs, predetermined rates based upon actual normal experience should be used. If it is found that these rates are too low or too high because of variations from normal conditions, the rates can, and of course should be, adjusted.

The survey of a plant may disclose the fact that it is not properly departmentalized. If such a condition exists, proper departmentalization must be made before overhead rates can be established and applied to production, because overhead rates are predetermined by departments or production centers.

Factory Overhead Budget Illustrated and Explained. In order to fully understand how the normal overhead rates are ascertained, a budget of factory overhead expenses is presented in Figure 21. The various expenses are estimated from past experience in relation to normal output. The expenses of several years may be studied in connection with anticipations of increased expenditures for the ensuing year, in order to arrive at standard expense items. These items of expense must then be applied to the operating departments, because it is in these departments that the materials are worked on in the process of manufacture and where the overhead rates are applied to the products.

In Figure 21 there are five groups of factory expenses which will be applied to the production orders of the ensuing year in the following manner:

Group 1, which constitutes the general overhead expenses, will be applied to the departmental direct-labor time of every production order thru the use of departmental overhead rates, based upon the average annual direct-labor hours.

Groups 2, 3, 4, and 5 constitute all items applicable to machine or other production centers. The total of these expenses for each production center will be applied to the production orders according to the machine or other production center time which will be multiplied by the machine-hour rate or the rate per production center hour.

To illustrate, we will assume that the buildings include an office, 40x45 feet, two stories in height; a power plant, 40x50 feet; a one-story, ironclad storage building, 20x80 feet in which all raw materials, parts, subassemblies, and completed models are stored; a machine shop 75x100 feet, which we will designate as Department 1; a subassembly building 85x100 feet, designated as Department 2; and a final assembly building, 50x80 feet, designated as Department 3.

The overhead expenses are classified in the following groups:

General Overhead Expense
Power Expense
Lighting Expense
Space Charges
Machine or Production Center Charges

This classification will be more clearly understood when overhead rates have been explained in Chapter VIII.

Group No.	Items	Basis of Distribution	Operating Departments: Dept. 1	Dept. 2	Dept. 3	Total
1.	General Overhead Expense:					
	Departmental Indirect Labor	Estimated from Pay Rolls	$ 3,000.00	$ 3,200.00	$ 1,000.00	$ 7,200.00
	Lost Time	Estimated from Pay Rolls	480.00	550.00	300.00	1,330.00
	Defective Work	Estimated	670.00	....	....	670.00
	Liability Insurance	Estimated Pay Rolls	1,000.00	1,100.00	700.00	2,800.00
	General Departments Expense (Schedule 1)	Total Labor Hours	8,000.00	8,267.00	3,733.00	20,000.00
	Total General Overhead Expense		$13,150.00	$13,117.00	$ 5,733.00	$32,000.00
2.	Power Expense (Schedule 2A)	Horse Power	$11,823.50	$ 7,094.10	$ 4,729.40	$23,647.00
3.	Lighting Expense (Schedule 2B)	Number of Lights	695.50	869.37	695.50	2,260.37
4.	Space Charges:					
	Heating Expense (Schedule 2C)	Cubical Contents	414.00	469.20	220.80	1,104.00
	Land and Building Tax (Schedule 3)	Floor Space Occupied	750.00	1,070.00	530.00	2,350.00
	Building Insurance (Schedule 5)	Floor Space Occupied	320.00	480.00	240.00	1,040.00
	Building Depreciation (Schedule 7)	Floor Space Occupied	800.00	1,200.00	600.00	2,600.00
	Building Repairs (Schedule 8)	Floor Space Occupied	360.00	480.00	240.00	1,080.00
	Total Space Charges		$ 2,644.00	$ 3,699.20	$ 1,830.80	$ 8,174.00
5.	Expense of Production Centers:					
	Personal Property Tax (Schedule 4)	Value	$ 1,125.00	$ 480.00	$ 450.00	$ 2,055.00
	Insurance--Machinery and Equip. (Schedule 6)	Value	600.00	256.00	240.00	1,096.00
	Depreciation--Machinery and Equip.	Value	7,000.00	3,000.00	2,800.00	12,800.00
	Repairs--Machinery and Equip.	Estimated	800.00	375.00	320.00	1,495.00
	Tools Expense	Estimated	250.00	75.00	50.00	375.00
	Manufacturing Supplies	Estimated	1,320.00	784.00	550.00	2,654.00
	Total Production Center Charges		$11,095.00	$ 4,970.00	$ 4,410.00	$20,475.00
	Grand Total Factory Expense		$39,408.00	$29,749.67	$17,398.70	$86,556.37

FIGURE 21.

Indirect Labor. Most indirect labor is definitely chargeable to certain departments, designated as departmental indirect labor. By studying the departmental indirect labor from the pay-roll analysis of previous years, a close estimate of this class of labor can be made for the ensuing year, as is shown in Figure 21.

Lost Time. The method of reporting the lost time of workers whose time is expended on production has already been explained in connection with the direct-labor cost sheet. Among the more important causes of lost time are the following:

1. Waiting assignment to definite pieces of work.
2. Repairing machines or other equipment (outside of regular repairs).
3. Lack of material.
4. Unavoidable interruptions to the routine of production.

The lost time which is a result of these delays is charged to the departments responsible for them, as has been shown in the departmental pay roll. If lost time is properly analyzed and reported, it can and should be investigated. Such wastage of time may be reduced to a minimum.

Defective Work. The treatment of defective work depends largely upon the nature of the product manufactured. If adequate inspection methods are used, defective work may, in many cases, be reduced to a minimum. In spite of close inspection, defective work arises and provision must be made for it in absorbing the general factory overhead. The method of handling defective work will be treated in a later chapter. It is, however, necessary to state here that defective

work should be charged to the departments responsible for it. If this is not possible, it may be distributed to the productive departments where the defects take place on the basis of departmental average annual direct-labor hours. The defective work stated in Figure 21 is an estimate taken from the production records of past performances in the machine shop.

Liability and Compensation Insurance. Unlike any other kind of insurance, liability and compensation insurance bears a direct relation to labor. It depends entirely upon the total of the pay rolls and also upon the classes of labor, as specified by the insurance policy. For an office employe whose liability to accident in the factory is not great, the rate may be $0.10 per $100.00 of the pay roll; for the operator of a printing press the rate may be $2.00 per $100.00; and for workers doing very dangerous work, where the risk to accident is great, the liability rate may be as high as $8.00 per $100.00 of the pay roll.

The compensation insurance is paid in advance, quarterly or semiannually as the case may be. The amount of insurance premium to be paid is based upon an estimated pay roll, classified in accordance with the risks involved, as stated in the policy. The amount for each class of labor is multiplied by its liability rate per $100.00 of the pay roll. This necessitates the classification of each departmental pay roll, as specified by the insurance policy, in order to ascertain the actual insurance which will have to be paid for each department. After the liability and compensation insurance expense is ascertained for each department, it is included in the general overhead to determine the departmental general overhead rate.

In order to determine the liability insurance, estimated pay rolls for the year must be departmentally prepared for all labor within the operating departments and analyzed according to the risks specified in the policy. The rates are then applied to these values to ascertain the amount of the liability insurance to provide for the ensuing year.

General Departments. In all well-organized plants, there are a number of so-called "general" departments. For example, in a plant of average size there will probably be the general superintendent's office, with his assistants, two or three stenographers, and half a dozen clerks for various kinds of work. The plant may also have a cost department of, let us say, ten or fifteen people who are keeping costs, both direct and indirect, for the entire plant operations.

In addition there may be a pay-roll department employing five or six people who compile the pay rolls for the entire plant. In the larger organizations there will be the engineering department, the planning department, the production department, and in some cases a personnel department. They are all auxiliary to general factory management and act as direct aids to the plant manager or general superintendent. In most cases the overhead of these departments cannot be charged to individual production orders, because they benefit all production.

However, in the case of special orders, blue prints and drawings may be charged to such orders. In the case of stock production, it would be impractical to charge the drafting and blue printing expense against any particular production order, because the same blue

prints and drawings will serve a great many production orders.

Where production is general, a fair basis for distribution of the expense of general departments should be established. The procedure in the majority of cases consists of prorating the general departments' expense to the productive departments on the basis of the direct-labor hours of each department. This method may be shown to be inaccurate. The general superintendent's office, the cost department, the pay-roll department, and all other general departments are concerned just as much with the indirect labor as with the direct. The general superintendent may, for example, expend just as much effort to supervise and regulate the indirect workers as the direct ones. Likewise, it also requires just as much time, in proportion, to account for the cost of indirect wages as for direct.

To illustrate: Department 1 may have 25,000 average annual direct-labor hours and 15,000 average annual indirect-labor hours, while Department 2 may have 15,000 average annual direct-labor hours and 25,000 average annual indirect-labor hours. If the general departments' expense amounts to $8,000.00 and is distributed to operating departments on the basis of direct-labor hours, then Department 1 would be charged with $5,000.00 (5/8 of $8,000.00), and Department 2 would be charged with $3,000.00 (3/8 of $8,000.00). Each department may have the same number of men, all of whom must be supervised by the superintendent. Their time must be accounted for by the payroll and cost departments.

Consequently, the proper basis of distribution of general departments' expense should be the total labor

hours of each department. In the preceding case, each department would accordingly be charged with an equal proportion of the general departments' expense. Too much attention cannot be given to the problem of properly departmentalizing the indirect operations as illustrated in the departmental pay roll and the payroll summary in Chapter V, so that a correct distribution of these expenses may be made to the various operating departments.

Analyzing the Activities of General Departments. In large factory organizations an account is often kept with each department, thus furnishing information for managerial purposes. This plan involves considerable detail in accounting for departmental expenses, so that quite frequently we find the expenses of general departments thrown into one general account. This account must be analyzed to ascertain what portion of general departments' expense should be assessed to manufacturing, and how much is a charge to the selling and administrative functions. In many factories the greater portion of the general departments' expense is applicable to manufacturing. After the amount of this expense chargeable to the factory for the current year has been determined, it must then be distributed to the various operating departments on the basis of the departmental average annual labor hours.

To illustrate, Schedule 1 shown in Figure 22 shows an analysis of general departments' expense, all of which is applied to manufacturing. The total must be distributed to the operating departments. If the average annual labor hours for Department 1 are 60,000 hours; for Department 2, 62,000; and for Department 3, 28,000 hours, the general departments' expense is

prorated 60/150 to Department 1, 62/150 to Department 2, and 28/150 to Department 3, as is shown in Figure 21.

GENERAL DEPARTMENTS' EXPENSE
YEAR 19

SCHEDULE 1

General Indirect Labor:		
Supervision, Janitors, Elevator men, Truckmen, etc.	$3,000.00	
Liability Insurance	24.00	$ 3,024.00
Salaries:		
Superintendent's Office	$6,500.00	
Cost Department	4,000.00	
Pay-Roll and Employment Dept.	3,500.00	
Liability Insurance (Office Employes)	10.00	14,010.00
Office Expense:		
Office Supplies	$ 380.00	
Stationery and Printing	200.00	
Miscellaneous	500.00	1,080.00
Apportionment Expense:		
Land and Building Tax	$ 90.00	
Property Tax	50.00	
Insurance--Building	40.00	
Insurance--Equipment	30.00	
Depreciation--Building	150.00	
Depreciation--Equipment	60.00	
Repairs--Building	84.00	
Repairs--Equipment	46.00	
Lighting Expense	139.20	
Heating Expense	82.80	772.00
Miscellaneous		1,114.00
Total		$20,000.00

FIGURE 22.

Light, Heat, and Power. Power expense is the most important of these. Its determination will vary with the nature and distribution of the power. It may be furnished by an outside agency, in which case the larger portion of the expense will appear in the power bills. In order to set up a typical case, we will assume

a modern steam plant. The procedure in this case will parallel that of a plant operated by electricity generated within the plant.

A power plant is not merely the boiler room, engine house, and the facilities and equipment necessary to generate and distribute power, but also includes the entire transmission equipment down to the pulley of the individual productive machine using power. Briefly stated, all the factors involved in power creation and distribution are as follows:

1. Taxes, insurance, depreciation, and repairs applicable to the buildings used for power generation.
2. Taxes, insurance, depreciation, and repairs on boilers, engines, and all other equipment in the generating department.
3. Taxes, insurance, depreciation, and repairs of the entire transmission facilities and equipment, such as belting, line shafts, pulleys, etc.
4. Salaries and wages of the power department superintendent, firemen, engineers, coal unloaders (if by hand), cleaners, oilers, belt repairmen, and all labor utilized to operate or maintain the power plant.
5. Expenditures for materials used in the production and distribution of power, such as water, coal, oils, greases, belt lacing, waste, and for repair materials and supplies. If a separate storeroom is necessary, then also the entire expenditures for operating and maintaining the storeroom, including wages, taxes, insurance, and depreciation.

As in the case of indirect labor, an hourly rate for power consumption must be established on the basis of the average annual departmental consumption, first, and then applied to the power requirements of the individual machine, groups of machines, or production

Light, Heat, and Power
Year 19

SCHEDULE 2

Power Buildings:		
Taxes (including proportion of land tax)	$ 250.00	
Insurance	112.00	
Depreciation	560.00	
Repairs	198.00	$ 1,120.00
Boilers, Engines, and other Equipment:		
Taxes	$ 650.00	
Insurance	250.00	
Depreciation	1,000.00	
Repairs	400.00	2,300.00
Transmission Facilities:		
Taxes	$ 100.00	
Insurance	50.00	
Depreciation	200.00	
Repairs	100.00	450.00
Salaries and Wages:		
Superintendent and Foreman	$ 3,000.00	
Firemen	3,000.00	
Engineers	5,000.00	
Coal Unloaders	1,500.00	
Oilers, Cleaners, etc.	3,500.00	
Liability Insurance	100.00	16,100.00
Materials and Supplies:		
Water	$ 600.00	
Coal	6,000.00	
Oils and Grease	500.00	
Belt Lacing	100.00	
Waste	100.00	
Repair Materials	250.00	
Miscellaneous Supplies	300.00	7,850.00
Total Annual Expense for Light, Heat, and Power		$27,820.00
Distribution:		
85% Power Expense (Schedule 2A)	$23,647.00	
5% Heating Expense (Schedule 2C)	1,391.00	
10% Lighting Expense (Schedule 2B)	2,782.00	$27,820.00

Figure 23.

centers, and finally to the machine hour. In order to illustrate the procedure, Schedule 2, as shown in Figure 23, is prepared and incorporated in Figure 21.

Included in the overhead expenditures is the expense of the generation and distribution of light and heat as well as power. This expense must be separated. As a rule, light and heat are by-products of a power plant, because exhaust steam is generally sufficient to run electric dynamos or motors. The expense of lighting and heating consists largely of the tax, insurance, depreciation, and repairs incident to the maintenance of the machinery and equipment utilized for these purposes. Power expense would, in most cases, not be materially reduced if no heat or light were produced. Some separation between light, heat, and power expense must be made, because the first two will be prorated to the various departments on a different basis than power. In every case the conditions must be studied in the light of past experience. The distribution in Schedule 2 is as follows:

Power Expense	85%
Lighting Expense	10%
Heating Expense	5%

Distribution of Power Expense. The power expense of $23,647.00 must be distributed to those departments in which power is used. If meters are installed in the departments, the meter readings may be the basis of distribution. Where meter readings are not available, the horsepower requirements of the various departments may be the basis of distribution. The horsepower requirements of all standard machines are matters of record and may be readily ascertained. For

instance, the power plant capacity is 500 H.P., and the departmental requirements are 250 H.P. for Department 1, 150 H.P. for Department 2, and 100 H.P. for Department 3. Schedule 2A as shown in Figure 24 would then be made and incorporated in Figure 21:

DISTRIBUTION OF POWER EXPENSE
YEAR 19

SCHEDULE 2A

	Dept. 1	Dept. 2	Dept. 3	Total
Horsepower	250	150	100	500
Proportion of Total. .	1/2	3/10	1/5	10/10
Distribution of Power Expense	$11,823.50	$7,094.10	$4,729.40	$23,647.00

FIGURE 24.

Distribution of Lighting Expense. Lighting expense should be prorated to the various departments in accordance with the number of lamps used. In Schedule 2B (Figure 25), the distribution is made to the various buildings on this basis. A further distribution must be made to the departments in the office building

DISTRIBUTION OF LIGHTING EXPENSE
YEAR 19

SCHEDULE 2B

Buildings	Number of Lights	Proportion of Total	Distribution
Office.	50	50/400	$ 347.75
Storage	25	25/400	173.88
Dept. 1--Machine Shop	100	100/400	695.50
Dept. 2--Subassembly.	125	125/400	869.37
Dept. 3--Final Assembly	100	100/400	695.50
Totals	400	400/400	$2,782.00

FIGURE 25.

on the basis of the number of lights in each department, so that the general departments will be charged with the proper proportion of the lighting expense, as shown in Schedule 1 (Figure 22).

Distribution of Heating Expense. Heat should be prorated on the basis of radiation or of relative cubical contents of the various departments. The distribution is made to the various buildings in Schedule 2C shown in Figure 26. A further distribution must be made to the departments in the office building so that the general departments will receive a proper charge.

DISTRIBUTION OF HEATING EXPENSE

SCHEDULE 2C

Buildings	Cubical Contents	Proportion of Total	Distribution
Office.	36,000	36/252	$ 198.70
Storage	16,000	16/252	88.30
Dept. 1--Machine Shop	75,000	75/252	414.00
Dept. 2--Subassembly.	85,000	85/252	469.20
Dept. 3--Final Assembly	40,000	40/252	220.80
Totals	252,000	252/252	$1,391.00

FIGURE 26.

Taxes. The tax burden should be applied only on the basis of the previous year, or from the assessment at the beginning of each operating year. The tax burden should be separated so as to show tax on land, tax on buildings, and tax on personal property, including machinery and equipment. If such a separation does not appear on the tax bill, the total should be prorated in accordance with the land, building, and personal property values shown on the books.

In cases where part of the land owned by a manufacturing concern is vacant and held for further plant expansion, it is necessary to know the tax cost of such

property so that the tax is not charged to production. The remainder of the land tax will be charged to the various buildings, on the basis of areas they cover. The height of the building makes no difference.

In the following illustrations, the total annual tax is $6,162.00, of which $762.00 represents land tax, $2,-400.00 building tax, and $3,000.00 personal property tax. Let us assume that one-third of the land is held for plant expansion. One-third of the $762.00 land tax, or $254.00, must be charged to an account, Tax on Unused Land, and the remainder, or $508.00, will be prorated to the various buildings in proportion to their flat floor area, as follows:

Building	Feet Dimension	Sq. Ft. Flat Area	Proportion of Total	Distribution of Land Tax
Office	40x 45	1,800	18/254	$ 36.00
Power	40x 50	2,000	20/254	40.00
Storage	20x 80	1,600	16/254	32.00
Machine Shop	75x100	7,500	75/254	150.00
Subassembly	85x100	8,500	85/254	170.00
Final Assembly	50x 80	4,000	40/254	80.00
Totals		25,400	254/254	$508.00

The buildings tax of $2,400.00 must be allocated to the various buildings in proportion to their relative values. Stating values to the buildings, the distribution will be made in the following manner:

Building	Values	Proportion of Total Value	Distribution of Buildings Tax
Office	$ 12,000.00	12/160	$ 180.00
Power	14,000.00	14/160	210.00
Storage	4,000.00	4/160	60.00
Machine Shop	40,000.00	40/160	600.00
Subassembly	60,000.00	60/160	900.00
Final Assembly	30,000.00	30/160	450.00
Totals	$160,000.00	160/160	$2,400.00

From the two preceding illustrations it is found that the various buildings are burdened with land and buildings taxes, as shown in Schedule 3 (Figure 27), and the distribution for operating departments is transferred to Figure 21.

LAND AND BUILDING TAX YEAR 19

SCHEDULE 3

Building	Portion of Land Tax	Portion of Buildings Tax	TOTAL
Office.	$ 36.00	$ 180.00	$ 216.00
Power	40.00	210.00	250.00
Storage	32.00	60.00	92.00
Machine Shop.	150.00	600.00	750.00
Subassembly	170.00	900.00	1,070.00
Final Assembly.	80.00	450.00	530.00
Totals	$508.00	$2,400.00	$2,908.00

FIGURE 27.

The personal-property tax of $3,000.00 represents the tax on all furniture and fixtures in the office and on all machinery and equipment in the power plant and productive departments. The personal-property tax is distributed to the buildings or departments on the basis of departmental values of equipment. Schedules of values of personal property in the various buildings and departments may be prepared from property records, which are explained in another part of this chapter. A rate of taxation per dollar of investment may be figured so that the tax expense of each department or machine can be readily fixed. In Schedule 4 the total value of personal property is $200,000.00. The tax rate per dollar of value would be 3/200, or $.015 and the distribution would be as shown in Figure 28.

The amounts chargeable to operating departments are transferred to Figure 21, and a portion of the tax for the office is chargeable to general departments.

DISTRIBUTION OF PERSONAL PROPERTY TAX
YEAR 19

SCHEDULE 4

Buildings	Property Values	Distribution of Tax
Office	$ 10,000.00	$ 150.00
Power	50,000.00	750.00
Storage	3,000.00	45.00
Machine Shop	75,000.00	1,125.00
Subassembly	32,000.00	480.00
Final Assembly	30,000.00	450.00
Totals	$200,000.00	$3,000.00

FIGURE 28.

Insurance. Insurance expense is of various kinds, and various methods for its distribution must be provided. Boiler insurance must be charged as part of power expense. Liability insurance bears a direct relationship to labor, and has already been considered. Fire insurance is based upon values invested in buildings and personal property. In a previous schedule, the charge to power expense for boiler insurance has been made and a portion of liability insurance prorated as part of the labor expense of the power department.

After deduction from the total premium of an amount necessary to cover the cost of insurance on the various stores of raw materials, finished parts, subassemblies, and finished product, which has been considered as a charge to inventories, the remainder of the premium may be allotted to buildings, machinery, and equipment on a unit of investment basis. If the balance of the premium is $2,880.00, and the total investment $360,000.00 (of which $160,000.00 represents buildings and $200,000.00 personal property), the insurance rate would be $.80 per $100.00 of value. If a blanket rate is

indicated in the policies and the insurable values coincide with the investment as shown on the books, then no rate computation for cost purposes is necessary, because the policy rate could be used. In Schedules 5 and 6 (Figures 29 and 30) it is assumed that separate policies are in force for buildings and personal property. The insurance on buildings, $1,280.00, is prorated to the buildings on the basis of the values of the buildings. The insurance on personal property is allocated to the buildings on the basis of the value of the property in the buildings. In both cases, however, a further distribution of the insurance for the office building must be made to the departments so that the general departments will share their portion as shown in Schedule 1 (Figure 22).

Depreciation. Depreciation is such a variable element of cost that no simple schedule based upon values alone can be used to illustrate its application. Not only do values enter into the problem but also the estimated life of building, machinery, and equipment which also varies because the different uses to which they may be put may change frequently. It is necessary to compute all these elements in advance, in considering depreciation.

In our discussion of insurance and tax expenses we have assumed building investments as follows: Office $12,000.00, power $14,000.00, storage $4,000.00, machine shop $40,000.00, subassembly $60,000.00, and final assembly $30,000.00. Let us carry the illustration further. The office building is of brick with an estimated life of 33 1/3 years. The power building is of brick with an estimated life of 25 years. The estimated life of the storage building is 40 years, while that of the

INSURANCE ON BUILDINGS
YEAR 19

SCHEDULE 5

Buildings	Building Values	Proportion to Total	Distribution of Insurance
Office	$ 12,000.00	12/160	$ 96.00
Power.	14,000.00	14/160	112.00
Storage.	4,000.00	4/160	32.00
Machine Shop	40,000.00	40/160	320.00
Subassembly.	60,000.00	60/160	480.00
Final Assembly	30,000.00	30/160	240.00
Totals.	$160,000.00	160/160	$1,280.00

FIGURE 29.

INSURANCE ON PERSONAL PROPERTY
YEAR 19

SCHEDULE 6

Buildings	Property Values	Rate Per $100	Distribution of Insurance
Office	$ 10,000.00	$0.80	$ 80.00
Power.	50,000.00	.80	400.00
Storage.	3,000.00	.80	24.00
Machine Shop	75,000.00	.80	600.00
Subassembly.	32,000.00	.80	256.00
Final Assembly	30,000.00	.80	240.00
Totals.	$200,000.00		$1,600.00

FIGURE 30.

machine shop, subassembly, and final assembly plants is 50 years each. Scrap and salvage values are to be disregarded. In this case the annual building depreciation would be computed as shown in Schedule 7 (Figure 31).

The depreciation of machinery and equipment is also calculated by departments and the expense included in Figure 21.

DEPRECIATION OF BUILDINGS
YEAR 19

SCHEDULE 7

Buildings	Assumed Values	Estimated Life	Annual Building Depreciation
Office	$ 12,000.00	33 1/3	$ 360.00
Power	14,000.00	25	560.00
Storage	4,000.00	40	100.00
Machine Shop	40,000.00	50	800.00
Subassembly	60,000.00	50	1,200.00
Final Assembly	30,000.00	50	600.00
Totals	$160,000.00		$3,620.00

FIGURE 31.

Property Ledgers. As in the case of buildings, the value, estimated life, and use of each piece of equipment or machine must be determined before depreciation can be charged. This is accomplished by the use of property ledgers, in card form, which should be classified according to buildings and subclassified by departments. An interchange of machines between departments can be recorded by making corresponding changes in the location of the cards.

Property cards should contain all essential facts regarding the property. In the case of a machine this information should list the date purchased, the invoice cost, the in-freight, the cost of installation, the total investment complete, the manufacturer's name and number, the departmental location and number, estimated life, annual rate of depreciation, hourly rate of depreciation, and the scrap value. The ledger card should provide spaces for replacements and renewals charged against the depreciation reserve, for repairs and maintenance charges, and for residual values. As a machine-hour rate is to be used for factory over-

heads, the machine-hour rate should also be shown for each year or each period. This will enable the management to know the rate used without reference to the tabulations, and should be of considerable value to any executive interested in estimates. The form shown in Figure 32 is suggested for a property ledger card.

Kind, Machine Type, Reamer Dept., 1			PROPERTY LEDGER Machine No., 19		Manuf. Name, X. Mfg. Co. Manuf. No., 296R Date Installed, 1/1			
Year	Value Beginning of Year	Depreciation	Replacements and Renewals	Residual Value	Repairs and Upkeep		Machine Hr. Overhead Rate	
					Year	Amount	Year	Rate
1931	$1300.00	$120.00	$ 20.00	$1200.00	1931	$10.00		
1932	1200.00	120.00	100.00	1180.00	1932	15.00		
1933	1180.00	120.00	160.00	1220.00	1933	12.00		
1934	1220.00	120.00	100.00	1200.00	1934	10.00		
Invoice Cost, $1,000.00. In-Freight, $100.00. Installation, $200.00. Total, $1,300.00								
Estimated Life, 10 Years. Scrap Value, $100.00. Depreciable Value, $1,200.00								
Annual Depreciation, $120.00. Hours per Year, 2,400. Hourly Rate, $0.05								

FIGURE 32.

Cards Show Condition of Depreciable Property. When used for all depreciable property, this form will not only show the net investment per general ledger controlling accounts (book value and replacements and renewals charged against depreciation reserve or book values minus net depreciation reserve), but will show the departmental policies of machine maintenance and the true operating value of all machines. It will show

also at what time replacements and renewals will increase or decrease repairs, and at what time it may actually be profitable to scrap the machine for a new one. Altho the form indicates that the replacements and renewals cut down the repairs, a point may, nevertheless, be reached, after the fourth year, when, even with larger replacements, the repairs would climb so high that a new machine should be purchased. As a rule, when an estimated life is used for fixing depreciation, the assumption is that the machine will operate efficiently for the estimated period, and that only at the end of that period should the machine be scrapped. If a machine can, from time to time, be completely replaced by renewing parts, then it may be profitable to operate the machine for several years beyond its estimated life. One of the objects of factory management is to keep machinery at the point of maximum production. This can be done only by keeping the value of the investment as close to the original cost as possible, which means that the charges to the depreciation reserve for replacements should be about equal to the depreciation reserve provided.

Thru a property ledger it will also be possible to compare the same types of machines manufactured by different manufacturers, so that only the most economical and effective machine may be installed. The property ledger columns serve as a check against the general ledger totals. A summary of the depreciation columns should agree with the total charges thru the general books for depreciation credited in turn to various depreciation reserves. Summary of the replacements and renewals columns should check with the charges made to the depreciation reserves. Likewise, the summary of the repairs and upkeep columns

should tally with the charges against repair reserves in the general ledger. The total repairs on the property ledger cards will furnish an excellent index for the creation of future repair estimates for buildings and machinery, to be used by the cost department in arriving at the amounts to be set aside for Repair Reserve Accounts.

Depreciation Methods. The property ledger form as filled in suggests the use of the straight-line method of depreciation. This method is, as a rule, the preferable one, altho from a theoretical standpoint a fixed rate on diminishing values appears more logical. Some accountants contend that this latter method tends to equalize the total maintenance charges on equipment and property year by year. By using a fixed rate on diminishing values, the sum of repairs and depreciation will be about equal each year, the repairs being small for the earlier years and the depreciation large.

Year	Depreciable Value Beginning Each Year	Annual Depreciation	Annual Repairs	Total Annual Charges
1	$1,000.00	$125.00	$ 10.00	$ 135.00
2	875.00	109.38	25.62	135.00
3	765.62	95.70	39.30	135.00
4	669.92	83.74	51.26	135.00
5	586.18	73.27	61.73	135.00
6	512.91	64.11	70.89	135.00
7	448.80	56.10	78.90	135.00
8	392.70	49.09	85.91	135.00
9	343.61	42.95	92.05	135.00
10	300.66	37.58	97.42	135.00
11	263.08	32.89	102.11	135.00
12	230.19	28.77	106.23	135.00
13	201.42	25.18	109.82	135.00
14	176.24	22.03	112.97	135.00
15	154.21	19.28	115.72	135.00
		$865.07	$1,159.93	$2,025.00

In later years repairs will be large and depreciation small. The table shown on the opposite page will illustrate the method of a fixed rate on diminishing values, assuming the rate to be 12½ per cent.

The value of the machine at the end of the fifteenth year is \$134.93 (\$154.21—\$19.28). When added to the accrued depreciation, \$865.07, this shows the original \$1,000.00 value. It is assumed that the \$1,000.00 did not include a scrap value of \$100.00. If the machine were sold for \$200.00 at the beginning of the sixteenth year, the following entries would be necessary, it being understood that the book value was \$1,100.00, viz., the sum of the depreciable and scrap values:

Cash	\$200.00	
Depreciation Reserve	865.07	
Profit and Loss.	34.93	
To Machinery Account		\$1,100.00

To record sale of machine for \$200.00 whose scrap value was \$100.00 and balance of depreciation value \$134.93, a total book value of \$234.93.

The table illustrates the diminishing-value theory under the most favorable circumstances. The sum of depreciation and repairs is equal each year, and the depreciation goes down as the repairs go up. While as a theory it may be logical, it has been the author's experience that in actual practice it rarely registers the actual facts of depreciation. If a machine were left to eke out an existence, registering only depreciation and repairs, the theory might be applicable. In the life of a machine, however, a number of cycles may be noted, each cycle starting with a series of important replacements and renewals which cut down repairs, altho the amount of repairs shows a tendency to increase in each successive cycle. This simply means that depreciation increases as the machine grows older,

and that even with important replacements larger repairs become necessary. If this were not true, one might conclude that replacements and repairs would give an endless life to machinery. Such a plan would be just as reasonable as attempting to keep man from growing old thru medical care and attention.

If it were possible to work out definite life cycles for machines in advance, such schedules would represent the actual facts regarding machinery depreciation and repairs, but this is not possible. Schedules of this character would show a relatively small amount of depreciation and repairs during the first cycle, with practically no replacements, succeeded by larger amounts of depreciation, repairs, and replacements in the following cycles, even tho the replacements would tend to keep repairs at a minimum. In the life of all ordinary machines, a point is reached where the repairs cannot be kept below a certain level, even tho numerous replacements are made. When this point is reached, new machines must be purchased. If depreciation reserves were created on the assumption that depreciation increases with the age of the machine (which it does) and yet the point for machine abandonment cannot be predetermined, a situation would probably arise where the depreciation reserves would not be adequate at the time of abandonment.

Straight-Line Method. The straight-line method of depreciation seems to equalize these various inequalities, because it neither recognizes the fallacy of heavy early depreciation of the so-called "rate" on diminishing values, nor does it fall into the error of the inadequate depreciation for the early years predicted upon an acceptance of an estimate of machine life based

upon real facts which, however, are not determinable in advance. The straight-line method, especially if the obsolescence element is fully considered, will generally create a depreciation reserve quite ample to meet the contingency of machine abandonment, even tho this may occur before the completion of the estimated life of a machine.

The entire problem of depreciation, especially of machinery, will appear very simple if a machine is considered as an amount of concentrated human labor, and the investment in it as wages paid in advance. As the machine performs, it earns its wages, so that whatever we charge to depreciation is the amount of wage earned by the machine. As in the case of factory workers, a machine will work most effectively in its earlier years, repairs will be few, and production will be at a maximum. With age will come heavy replacements and increasing repairs corresponding to necessary bodily rehabilitations and doctor's attentions as a man grows old. In both cases there will be less energy and more frequent breakdowns. This similarity between machine and human labor has no doubt led to the establishment of hourly depreciation rates, as well as the machine-hour rate for the absorption of factory overhead.

Building and Machinery Repairs. It is impractical to consider repairs in a cost accounting scheme at the time they occur. Repairs vary so frequently and so widely that if they were considered at the time they occurred, the machine-hour rate of overhead would have to be modified constantly during an accounting period, in order to take care of the charges. This would be an almost impossible task. Repairs do not benefit

merely the week or month in which they are made; their influence is felt for long periods. How then must building and machinery repairs be considered?

All factory overhead variables, for purposes of fixing the machine-hour rate, must be estimated for a year, or for an accounting period. They must also be departmentalized for buildings, and classified for departments and machines so that fixed amounts may be used. These same fixed amounts based on past experiences will form the basis for the monthly general ledger charges, provided reserve accounts are created for repairs. The repair expense would be debited to Factory Expense Controlling Account and credited to accounts for repair reserves. The actual expenditures for repairs should then be charged, as they occur, against the reserves. For purposes of illustration consider the estimates of annual repairs to buildings shown in Schedule 8 (Figure 33):

BUILDING REPAIRS
YEAR 19.
SCHEDULE 8

Building	Estimated Annual Repairs	Monthly Portion
Office	$ 200.00	$ 16.67
Power	198.00	16.50
Storage	60.00	5.00
Machine Shop	360.00	30.00
Subassembly	480.00	40.00
Final Assembly	240.00	20.00
Totals	$1,538.00	$128.17

FIGURE 33.

The charges to the office building must be prorated proportionately to selling, general office, and general departments; the charges to storage are provided in the estimates used to establish stores burden rates.

The monthly journal entry would be somewhat as follows:

General Office Expense		$ 6.45	
Selling Expense		3.22	
Factory Expense Controlling Account		113.50	
General Departments	$ 7.00		
Light, Heat, and Power	16.50		
Machine Shop	30.00		
Subassembly	40.00		
Final Assembly	20.00		
	$113.50		
Reserve for Stores Expense		5.00	
Reserve for Building Repairs			$128.17

There may be further provision for a separation of the Reserve for Building Repairs Account into the following:

Reserve for Repairs—Office Building
Reserve for Repairs—Power Building
Reserve for Repairs—Storage Building
Reserve for Repairs—Machine Shop
Reserve for Repairs—Subassembly Building
Reserve for Repairs—Final Assembly Building

The expenses for repairs to machinery and equipment may be estimated in a similar way and journalized monthly in the same manner as described for building repairs. No schedule is presented, but values are included in Figure 21 and the schedules for general departments and light, heat, and power.

Tool Repairs and Depreciation. Repairs on tools and tool depreciation must also be estimated from past experiences, and, whenever possible, allocated to definite machines or production centers. If a concern makes its own tools, its tool-repair department is generally combined with the tool-making department and the work handled by repair orders and orders for

new tools. This plan makes the tool department a regular manufacturing entity with its own raw materials, its own direct labor, and its own factory overhead. The production of new tools is handled along the same line as regular factory production orders. The completed orders appear in the Tools Inventory Account. In making tool repairs the name or number of the machine or production center served by the tool should appear on the order, so that an intelligent estimate may be made of the tool-repairs requirements for the various machines and manufacturing centers. Tool-repair expense should be added to tool depreciation as a part of the machine burden and the machine-hour rate. Chapter VIII will explain how the application is made.

Manufacturing Supplies. Whenever possible, manufacturing supplies should be charged directly to production orders. This can generally be done if the requisition method for manufacturing supplies is in force and such supplies are treated as regular inventories. Some supplies are for general purposes, and their use benefits many production orders. In such cases the supplies benefit the machine or the production center. An estimate of the amounts and values required for a year should be made and incorporated as a part of the machine or production center overhead. Supplies that are furnished primarily as an aid to indirect labor may be considered an indirect-labor expense, and thus form a part of the departmental general overhead charge. Supplies to be used for power creation, power transmission, or for power department repairs are estimated and provided for in the schedule for light, heat, and power.

Chapter VIII

THE DETERMINATION OF OVERHEAD RATES

The machine-hour rate as an effective plan for factory overhead allocation puzzles many executives to whom it apparently means little more than red tape, elaborate calculations, and tremendous expense. The method of using machine hours as the basis of applying overhead cost has been developed in many cases into a very complex procedure. The effect has often been detrimental to the progress of cost accounting.

The Principle of Machine-Hour Plan. The fundamental principle on which the machine-hour method is based requires that each unit of production shall be charged with a portion of factory overhead according to the time that a machine spends in turning out the product. In the majority of manufacturing industries this princple must be recognized and carefully considered, if the costs are to be at all correct.

But to allocate all the manufacturing expenses of a department to the various machine centers in order to determine machine-hour rates, involves an enormous amount of detail. Indirect labor, supervision, lost time, the expenses of general departments, and other items of a similar nature have really no relation whatever to the machine centers within a department.

Such items have no purpose in the machine cost. They should, therefore, be excluded and be handled thru the use of the direct-labor-hour rate as a general overhead charge for the department.

The items which are really involved in computing the machine-hour rate are:

Power Expense
Lighting Expense
Space or Rent charges (taxes, insurance, depreciation, and repairs of building).
Machine charges (tax, insurance, depreciation, and repair of machines, tool expense, and supplies used).

Predetermining General Overhead Rates. In the previous chapter we have set up in Figure 21 a budget of factory expenses for the operating departments, which will be used in establishing the predetermined overhead rates for the ensuing year. In this exhibit we find that the annual general overhead expenses show for Department 1, $13,150.00; for Department 2, $13,117.00; and for Department 3, $5,733.00. The average annual direct-labor-hour expenditure for normal production, let us assume, is 48,000 hours for Department 1; 50,000 hours for Department 2; and 25,000 hours for Department 3. The departmental overhead rates will then be computed as follows:

	Dept. 1	Dept. 2	Dept. 3	Total
Annual Direct-Labor Hours	48,000	50,000	25,000	123,000
Estimated Annual General Overhead Expense (per Figure 21)	$13,150.00	$13,117.00	$ 5,733.00	$ 32,000.00
Departmental Rate per Direct-Labor Hour . . .	$0.274	$0.261	$0.229	

If, during a current cost period, 100 direct-labor hours have been spent in Department 1 on a given production order, $27.40 (100 hours × $0.274) would be the amount of the general overhead expense to be charged to the order. In a similar manner the rates for Departments 2 and 3 would be applied to the

departmental direct-labor time spent on each production order to ascertain the portion of the departmental general overhead expense which each order should bear.

Predetermining Machine-Hour Rates. To demonstrate how machine-hour rates are determined, let us consider three machine centers in Department 1. These machine centers are designated as 1-A, 1-B, and 1-C, the figure "1" being prefixed to denote the department number. In machine center 1-A there is but one machine, which occupies 500 square feet of floor space. It has a capacity of 10 horse power and requires the use of five lights. In machine center 1-B there are ten machines of the same type, capacity, and value occupying 3,000 square feet of floor space and having a total cost value of $40,000.00, with an estimated scrap value of $3,000.00. The horse power capacity is 160, and 70 lights are used. In machine center 1-C there are four machines of the same type, capacity, and value, occupying 4,000 square feet of floor space and having a total cost value of $33,700.00, with an estimated scrap value of $1,900.00. The horse power capacity is 80, and 25 lights are used.

With the preceding information available, the expense items of Department 1, shown in Figure 21, which are involved in determining machine-hour rates, are distributed to machine centers in the following manner:

1. Power expense according to horsepower requirements.
2. Lighting expense according to number of lights used.
3. Space charges according to square feet of floor space occupied.

4. Taxes, insurance, and repairs of machinery equipment according to values.
5. Depreciation according to a percentage of original cost less scrap value.
6. Tools expense and manufacturing supplies estimated for each center according to past performances.

After all of the expenses of Department 1 have been allocated to the machine centers, the expense applicable to individual machines can be determined by dividing the total expense of each center by the number of machines. This amount divided by the normal operating hours of the machine will give the machine-hour rate to be used for the ensuing year in charging machine overhead to production orders. The statement outlined in Figure 34 will show how the expenses of Department 1 are allocated to the machine centers and how the machine rates are ascertained.

To demonstrate more fully how the machine-hour rate is determined, let us take Machine No. 19 in machine center 1-A of Department 1. In our discussion of factory overhead, we found that the following amounts were applicable to Department 1:

Power Expense.	$11,823.50	250 H. P.
Lighting Expense	695.50	100 Lamps
Heating Expense.	414.00	75,000 Cu. Ft.
Land Tax	150.00	7,500 Sq. Ft.
Building Tax	600.00	$40,000.00 Value
Insurance (building)	320.00	$40,000.00
Depreciation (building). . . .	800.00	$40,000.00 (50 Years)
Estimated Repairs (building) .	360.00	Chapter VII

Of these expenses, all except those for light and power may be considered as space or rent charges. They may, therefore, be charged to the machine in proportion to the square feet of space occupied or by a square drawn about the machine, giving it a proper

Department 1.—Machine Shop
Determination of Machine-Hour Rates

	Basis of Distribution	Machine Centers			Total
		1-A	1-B	1-C	
Basis for Distribution:					
1. Number of Machines in Each Center.	. . . . . .	1	10	4	15
2. Square Feet of Floor Space Occupied.	. . . . . .	500 Sq.Ft.	3,000 Sq.Ft.	4,000 Sq.Ft.	7,500 Sq.Ft.
3. Value of Machinery and Equipment in Each Center.	. . . . . .	$1,300.00	$40,000.00	$33,700.00	$75,000.00
3. Scrap Value of Machinery and Equipment . . .	. . . . . .	$100.00	$3,000.00	$1,900.00	$5,000.00
4. Horsepower Requirements	. . . . . .	10 H.P.	160 H.P.	80 H.P.	250 H.P.
5. Number of Lights in each Center.	. . . . . .	5	70	25	100
Departmental Charges:					
Power Expense	(4)	$472.94	$7,567.04	$3,783.52	$11,823.50
Lighting Expense.	(5)	34.77	486.85	173.88	695.50
Space Charges (per Figure 21)	(2)	176.27	1,057.60	1,410.13	2,644.00
Total Departmental Charges	. . . . . .	683.98	9,111.49	5,367.53	15,163.00
Machine Charges:					
Taxes	(3)	19.50	600.00	505.50	1,125.00
Insurance	(3)	10.40	320.00	269.60	600.00
Depreciation.	(3)	120.00	3,700.00	3,180.00	7,000.00
Repairs	Estimated	12.00	500.00	288.00	800.00
Tools Expense	Estimated	6.00	160.00	84.00	250.00
Manufacturing Supplies.	Estimated	20.00	875.00	425.00	1,320.00
Total Machine Charges.	Estimated	$187.90	$6,155.00	$4,752.10	$11,095.00
Total Machine Expense	. . . . . .	$ 871.88	$15,266.49	$10,119.63	$26,258.00
Overhead Expense of One Machine	. . . . . .	871.88	1,526.65	2,529.91	
Annual Normal Operating hours per Machine	. . . . . .	2,400.00	2,400.00	2,400.00	
INDIVIDUAL MACHINE-HOUR RATE.	. . . . . .	$0.3632	$0.6361	$1.0541	

Figure 34.

portion of the entire departmental space as related to the other machines. Assuming that the department is all on one floor having an area of 7,500 square feet, and that the machine requires 500 square feet (one-fifteenth of the total floor area), the proper departmental charges to be considered as space charges are:

Heating Expense	$ 414.00
Land Tax	150.00
Building Tax	600.00
Insurance (building)	320.00
Depreciation (building)	800.00
Estimated Repairs (building)	360.00
Total Space Charges	$2,644.00

One-fifteenth of $2,644.00 is $176.27, which is the amount of space charge in Department 1 annually applicable to Machine 19.

The annual power charge against Department 1 was fixed at $11,823.50, based upon a consumption of 250 H. P. In order to determine the amount to be allocated to Machine 19, the H. P. requirements of that machine must be calculated. If this is 10 H. P., then one-twenty-fifth (or $472.94) of the entire departmental power expense is chargeable to it.

Since the distribution of lighting expense is based upon the number of lamps used, it is logical that the departmental expense should be distributed to the machines in proportion to the number of lamps used for each machine. If five lamps are necessary in connection with Machine 19, then one-twentieth of the annual lighting expense ($695.50) or $34.77 is applicable.

Summarizing the annual charges against Machine 19 arising out of expenditures which the machine itself does not create, the following is the result:

Power Expense	$472.94
Lighting Expense	34.77
Departmental Space Charges	176.27
Total Extra Machine Charges	$683.98

The machine itself creates overhead, and an examination must be made of the various elements of overhead applicable to each machine. Turning to the property ledger form shown in Figure 32, we note that this machine represents an investment of $1,300.00, that its scrap value is $100.00, and that its estimated life is ten years. From this information we conclude that its annual depreciation is $120.00. Basing our estimate on past experience, by referring to the repairs expenditures, we find that $12.00 would be a fair estimate of the annual expenditures for repairs. But there are further expenses; namely, a portion of taxes, insurance, manufacturing supplies, tool repairs, and depreciation. The following table will summarize the machine's direct annual overhead:

Taxes ($1,300.00 @ $0.015 per dollar for the first year--Chap. VII)	$ 19.50
Insurance ($1,300.00 @ $0.80 per $100.00 for the first year--Chap. VII)	10.40
Depreciation	120.00
Estimated Repairs	12.00
Tool Repairs and Depreciation (Based upon tools used and their values)	6.00
Manufacturing Supplies (estimated)	20.00
	$187.90

After having summarized the overhead charges which are in the nature of departmental rent charges, and those which originate from the machine itself, a final summary shows the total machine overhead:

Departmental Charges	$683.98
Machine Charges	187.90
Total Machine Overhead	$871.88

To determine the machine-hour rate, the total annual machine overhead, $871.88, must be divided by the number of hours the machine operates each year, or, better, by the normal average hours the machine should operate each year. If this normal number of hours is 2,400, the machine-hour rate will equal $871.88 divided by 2,400, or $.3632. To allocate the overhead to production orders, the number of hours given to each order must be multiplied by the rate. If an order required seven hours, the overhead would be seven times $.3632, or $2.54.

The worker's daily time report, shown in Figure 14, provides space for each worker or timekeeper in which to indicate the machine number and the time worked at each machine. Figure 34A shows graphically how the various expenditures are allocated to the machine centers, and how the machine-hour rate is calculated.

A production center may be either a group of machines of the same or similar types or a bench or section where hand labor is employed, and should be handled in the same way as an individual machine.

By the normal number of machine hours per year is meant the greatest number of hours, under normal conditions, which any machine may perform during a year without working overtime. The advisability of using this figure to arrive at the hourly machine or production center rate is obvious, because many machines are not operated at normal maximum time. For purposes of illustration we have assumed that the yearly maximum of Machine 19 is 2,400 hours.

Figure 34-A

Graphic Distribution for Calculating Machine-Hour Rates

Maximum Machine Operation. The fact that machines do not work a normal maximum is, as a general rule, an indication either of an unavoidable general economic depression, or that one or a combination of several of three managerial defects are responsible:

1. Insufficient volume of business.
2. Excessive investment in machinery.
3. Improper proportioning of machines.

The responsibility for such defects should be fixed as soon as there is any suspicion that they exist. An effective cost accounting system, based upon the assumption that all machines should be operated at a normal maximum, is the only method by which such defects can be uncovered. If machines are not operated at the normal maximum number of hours, either the plant is not supplied with enough orders or the investment in machines is too large. If a larger volume of sales is impossible, or the machines are improperly arranged, some machines will be temporarily idle while others will have more than they can handle. This will result in a general curtailment of production for the plant as a whole.

In order to manufacture a product profitably, there must be a proper sequence of operations, each being performed by a number of machines of the same type in one or more departments, or in some cases by separate machines in one department. In each operation the machines are capable of producing certain measurable results in preparation for the next operation. On the basis of a certain volume of business, the results of one operation should, as closely as possible, dovetail with the requirements of the next operation. Any information which will aid management in deter-

mining the relationship of machine requirements to production, as expressed in a sequence of operations, is valuable in shaping policies for keeping a properly balanced machinery investment in constant peak activity, and in securing a proper balance between investment and production by operations where such balance does not exist. It is for this reason that the normal maximum of machine hours is recommended as the standard for the determination of the machine-hour rate for factory overhead distribution.

To illustrate this point: Consider two operations, A and B. For Operation A two machines are in use, and three for Operation B. One machine on Operation A works 2,400 hours a year, the normal maximum; the other 1,200 hours. All three machines on Operation B work 2,400 hours or a total of 7,200 hours. If it were possible to increase the volume of work, it would be apparent that the second machine on Operation A could be kept at a normal maximum by installing an additional machine for Operation B, on which each machine operates 2,400 hours to take care of the results achieved by 1,200 hours of machine work in Operation A. In other words, the machine proportioning between Operations A and B should be as 1 is to 2, or A : B :: 1 : 2, or A Hours : B Hours :: 1 : 2, which translated is 4,800: 9,600 :: 1: 2; multiplying the means and the extremes establishes the equality. But, if one machine on Operation A works only 1,200 hours per year, then, on the basis of 2,400 hours as the maximum, only one-half of the overhead has been absorbed. This unabsorbed portion is what is known as "Unearned Burden" or "Unabsorbed Overhead."

Unearned Burden. Unearned Burden or Unabsorbed Overhead cannot and should not be charged directly against the product, because the facilities for production bearing the burden rate have not operated in accordance with the tasks predetermined for them on a basis of a normal maximum. This type of overhead charge results from inefficiencies in production which, in most cases, are avoidable. If production were normal and efficient, there would be no unearned burden. Such conditions, however, are ideal and are rarely encountered in actual practice. This, however, does not mean that the cost accountant should not have these ideal conditions in mind as a guide in establishing a basis for the machine-hour rate determination in order that he may as closely as possible approach them.

If unearned burden statistics are compiled by departments, subdivided into operations, and operations subdivided into the individual machine or production center units, the relationship between operations and the relative equipment needs for the various operations may be readily determined.

In a seasonal business, machine-hour rates for overhead absorption must be based upon the estimated normal maximum hours of machine operation during the season. Where special tools or machines are necessary maximum performance should not be expected in all cases. In such cases a special rate based upon the expected performance of such special tools must be established as the normal maximum.

Charging Unearned Burden. It is not necessary to wait until the end of the year to determine the un-

earned burden of any machines, as the cost statistics for each month will indicate the amount. During each month, the number of hours which a machine should work on a normal maximum basis are known, and variations can be noted and followed up. The Unearned Burden Account will be charged each month with the overhead unabsorbed, because of idle machine hours, and corrections of the deficiency should be current. In this way the Unearned Burden Account becomes an index of machine productivity and effective machine arrangements.

Whether or not the unearned burden should be charged pro rata each month to total costs, or whether it should be charged direct to profit and loss, are questions which can only be answered from an analysis of a plant's products. If the products are fairly uniform and utilize practically the same facilities, the unearned burden might very properly be charged pro rata to the total established costs of the various products. Where production is varied, it might be unfair to prorate, because it would probably result in burdening a product which was in no way responsible for the unearned burden.

The author is inclined to favor the attitude of those who regard unearned burden as a profit and loss item. The amounts of unearned burden should not, however, be charged to profit and loss currently, but should remain in an Unearned Burden Account until the end of the accounting period when they may be added to the Cost of Sales, thus classifying them as an expense of manufacturing not chargeable definitely to production costs.

Whether the amounts appearing in the Unearned Burden Account should be considered in connection with price making, will depend upon a number of circumstances, chief of which is the competitive situation. But, if the unearned burden results from conditions that are unavoidable, then it may be considered as being normal and taken into account in price fixing. Where the unearned burden comes about because of abnormal conditions resulting from a business slump, it should be ignored in price making, because under such conditions the regular costs might not even be returned thru sales. If the unearned burden is to be considered in price making, the procedure to be followed is the simple one of adding a percentage covering the average annual unearned burden to total factory costs.

Day and Night Shifts. Whenever a plant works day and night shifts for any length of time, the normal maximum of hours on which the machine-hour rate is based should be increased to correspond. At the same time the amount of burden applicable to the machine will be increased; depreciation and repairs of buildings and machinery will be nearly doubled, and power, heat, and light will increase, as will also many of the other overhead expenditures. Taxes and insurance are about the only large items of overhead which will not be larger.

In cases where overtime is spasmodic, the author is of the opinion that, altho a credit must be made to the Unearned Burden Account in order to conform to an established basis, such a credit is not a profit and loss item, but merely a reserve. The overtime has

created some additional overhead, and the regular rate should be charged to product, even tho the total charges exceed the predetermined amount. At the end of the year the Unearned Burden Account will in all probability still show a debit balance, altho there may have been overtime. It should always be remembered that overtime does not reduce burden, altho it may absorb certain burden items.

It is quite apparent that the Unearned Burden Account, if properly analyzed, will afford the means for a very close study of machine operations and the balancing of machinery investment with operation needs. The methods of handling the Unearned Burden Account will be discussed in a later chapter.

Chapter IX

SUMMARY OF MACHINE BURDEN AND THE MASTER COST SHEET

After the machine-hour rate has been ascertained for the different machines or group of machines, some means must be provided for furnishing a history of the performance of each machine. A serviceable form for this purpose is illustrated in Figure 35. A careful examination of the laborer's daily time report for direct labor will reveal the fact that all the information necessary for the individual machine report is recorded by the operator of the machine on the time report. In reporting his time daily, the operator records on Figure 11, the Department, the machine number, the production order number, and the hours of machine performance. This information is summarized daily for each machine and recorded on a form such as Figure 35. This form not only shows the time that the machine works daily on each production order, but also the total time spent on each and every production order for the month.

It should be borne in mind that the operator is constantly working at a machine or in a production center for each of which a definite rate of overhead has been established, and that the laborer's daily time reports thus correctly report the number of machine or production center hours. Since the overhead rate for each machine has been predetermined, the amount of machine expense to be charged to the production orders

Month of JANUARY, 19____

Dept. (1) Machine Center 1-A | Machine No. 19 | Overhead Rate, $0.3632

Prod. Order	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Hrs.	Overhead
P. 131.	7	1																														8	$ 2.9056
P. 152.	1	7	6	6	8	8		6	5	4																						51	18.5232
P. 173.			2	2																												4	1.4528
P. 186.								2	2	4	8	8	8		7	6	5	5														55	19.9760
P. 192.															1	1	3	3	8	8		8	8	8								48	17.4336
P. 206.																									8	7	8		8	7	8	46	16.7072
TOTALS.	8	8	8	8	8	8		8	7	8	8	8	8		8	7	8	8	8	8		8	8	8	8	7	8		8	7	8	212	$76.9984
UNEARNED BURDEN									1							1										1				1		4	1.4528
	POSTED TO SUMMARY SHEET																															216	$78.4512

____________________ Cost Clerk.

Figure 35. Individual Machine Report.

SUMMARY OF MACHINE BURDEN

DEPARTMENT 1—MACHINE SHOP. MONTH OF JANUARY, 19

MACHINE CENTER	MACH. NO.	PRODUCTION ORDERS 131	152	173	186	192	206	TOTAL	UNEARNED BURDEN	GRAND TOTAL
1-A	19	$ 2.9056	$ 18.5232	$ 1.4528	$ 19.9760	$ 17.4336	$ 16.7072	$ 76.9984	$ 1.4528	$ 78.4512
1-B	20	$ 19.0830	$ 30.5328	$ 25.4440	$ 25.4440	$ 19.0830	$ 12.7220	$ 132.3088	$ 5.0888	$ 137.3976
1-B	21	12.7220	22.2635	9.5415	28.6245	31.8050	28.6245	133.5810	3.8166	137.3976
1-B	22	15.9025	19.0830	15.9025	25.4440	22.2635	31.8050	130.4005	6.9971	137.3976
1-B	23	3.1805	....	....	....	....	5.0888	8.2693	129.1283	137.3976
1-B	24	9.5415	15.9025	38.1660	50.8880	12.7220	10.1776	137.3976	....	137.3976
1-B	25	12.7220	19.0830	28.6245	22.2635	31.8050	22.2635	136.7615	.6361	137.3976
1-B	26	6.3610	22.2635	25.4440	38.1660	19.0830	24.1718	135.4893	1.9083	137.3976
1-B	27	9.5415	15.9025	44.5270	19.0830	31.8050	16.5386	137.3976	....	137.3976
1-B	28	15.9025	15.9025	25.4440	41.3465	31.8050	6.3610	136.7615	.6361	137.3976
1-B	29	3.1805	9.5415	19.0830	38.1660	38.1660	25.4440	133.5810	3.8166	137.3976
1-B	Total	$108.1370	$170.4748	$232.1765	$289.4255	$238.5375	$183.1968	$1,221.9481	$ 152.0279	$1,373.9760
1-C	30	....	$ 84.3280	....	$ 73.7870	$ 31.6230	$ 36.8935	$ 226.6315	$ 1.0541	$ 227.6856
1-C	31	$ 10.5410	73.7870	42.1640	26.3525	42.1640	32.6771	227.6856	....	227.6856
1-C	32	31.6230	....	79.0575	....	....	105.4100	216.0905	11.5951	227.6856
1-C	33	....	94.8690	....	63.2460	31.6230	37.9476	227.6856	....	227.6856
1-C	Total	$ 42.1640	$252.9840	$121.2215	$163.3855	$105.4100	$212.9282	$ 898.0932	$ 12.6492	$ 910.7424
Total		$153.2066	$441.9820	$354.8508	$472.7870	$361.3811	$412.8322	$2,197.0397	$ 166.1299	$2,363.1696

Posted to Master Cost Sheet.

____

Cost Clerk.

FIGURE 36.

MASTER COST SHEET

Parts Production Orders Completed

Month of January 19

Department 1—Machine Shop

Finished Orders		Material Cost	Direct-Labor		General Overhead	Machine Burden		Total Cost	Unit Cost
Order No.	Quantity		Hrs.	Cost		Hrs.	Cost		
131	50	$313.17	44	$ 42.50	$ 12.06	218	$153.21	$ 520.94	$ 10.42
Unit Cost		6.26		.85	.24		3.07	10.42	
152	100	$250.00	731	$438.60	$200.29	559	$441.98	$1,330.87	$ 13.31
Unit Cost		2.50		4.39	2.00		4.42	13.31	
173	200	$400.00	829	$488.95	$227.15	484	$354.85	$1,470.95	$ 7.35
Unit Cost		2.00		2.44	1.14		1.77	7.35	
Summary		$963.17	1,604	$970.05	$439.50	1,261	$950.04	$3,322.76	

Debit: Parts Inventory Account........$3,322.76

Credit: Production Orders in Process...........$3,322.76

Entry Made

....

Bookkeeper

Figure 37.

worked upon during the month is readily ascertained and recorded on the machine report.

Summary of Machine Burden. Quite frequently it will be found that several machines work upon the product for a given production order. There must be provided a summary of all the machine expense belonging to each and every production order. From the individual machine reports, a departmental summary of machine expense by machines, machine centers, and production orders is prepared. The form shown in Figure 36 provides a summary for this purpose.

With these summaries completed, sufficient information is available for the final compilation of costs for each production order on the master cost sheet. A form is shown in Figure 37 for parts production orders completed. The master cost sheet of completed production orders is a summary of the total costs of goods finished each month. Likewise, the master cost sheet of uncompleted production orders, at the close of a given month or period, is a summary of the material and direct-labor charges to production orders still in process at that date and the overhead expenses that are applicable to them.

A Master Sheet for Each Class of Orders. There should be a separate form of master cost sheet for each of the three classes of production orders; namely, parts, subassembly, and final assembly production orders. If separate costs are ascertained for the material, labor, and overhead costs on parts production orders, then the master cost sheet which summarizes these cost figures must be prepared for parts produc-

tion orders. The cost transactions of subassembly and final assembly production orders should also be summarized on master cost sheets for subassemblies and final assemblies.

Operation of Master Cost Sheet. To illustrate the operation of the master cost sheet, we will assume that the production orders tabulated on the summary of machine-burden form (Figure 36) are all parts production orders that have gone in a straight routing thru the various production centers of the machine shop, and that Production Orders 131, 152, and 173 have been completed, and Production Orders 186, 192, and 206 are still in process. Figure 37 presents the summarized costs for the finished orders. The material cost is summarized from the departmental material cost sheets for each production order. Reference to the material cost sheet will show the cost of material used in Department 1 on Production Order 131. Likewise, reference to Figure 17, the direct labor cost sheet for Department 1, will indicate how the time and labor cost is obtained and recorded on the master cost sheet for Production Order 131. After the direct-labor time and cost for Departments 2 and 3 have been recorded, the next step in determining the total cost of Order 131 is to apply the departmental general overhead rates which have already been predetermined on the basis of direct-labor hours. Reference to the tabulated statement shown on page 121 will show the departmental rates for general overhead expense. The departmental direct-labor time for each production order shown on the master cost sheet is multiplied by the departmental overhead rate per direct-labor hour, and the result is the departmental overhead to be charged to each order for general overhead.

The machine burden for Parts Production Order 131 is obtained from the summary of machine burden. On this form, not only the burden of each machine which worked on Order 131, but also the machine burden of each machine center is shown. These machine-burden values are recorded on the master cost sheet for each completed order, and the total costs are ascertained.

In the illustration given for the master cost sheet, it is assumed that the parts are made in quantity in the machine shop and placed in stores for later use in assembling complex mechanisms. The parts are then manufactured under an independent-parts production order, and when completed are placed in a finished-parts storeroom. If the machine shop had been subdivided into several departments, the material, labor, general overhead, and machine burden chargeable to each production order would have been shown for each department. The master cost sheet would then have shown the departmental costs.

To illustrate this form of the master cost sheet we will assume that there are three departments in the machine shop known as Departments 1, 2, and 3, and that Order 231 had accumulated costs recorded on the master cost sheet, as follows:

Order No.	Quantity	Dept. No.	Material Cost	Direct-Labor		General Overhead	Machine Burden	Total Cost	Unit Cost
				Hrs.	Cost				
231	50	1	$313.17	44	$ 42.50	$12.04	$13.48	$381.19	$ 7.62
		2	60.90	10	11.00	2.71	4.33	78.94	1.58
		3	89.56	60	58.25	13.84	42.81	204.46	4.09
Totals			$463.63	114	$111.75	$28.59	$60.62	$664.59	$13.29
Unit Cost			$ 9.27		$ 2.24	$ 0.57	$ 1.21	$ 13.29	

For every production order completed, this form of the master cost sheet will give not only the unit cost of each element of expense but also the departmental unit costs.

In some assembling industries, when the parts are completed, instead of going into a finished-parts storeroom, they are routed to the assembling departments where they are assembled into the finished product. In such a case, a main production order is issued for the mechanism as a whole and suborders are issued for the component parts. The master cost sheet is a convenient means of bringing the departmental costs together to ascertain the departmental unit costs and the unit cost of each expense element of the finished product. However, the former plan of providing intermediate storerooms and of costing parts and assembly production orders separately, is to be recommended.

The Value of Cost Analysis. A study of the master cost sheet will reveal the fact that the cost elements are analyzed in such a way that considerable value for management can be obtained. Not only does it show the total materials, direct labor, and factory overhead expended on production orders during any given month but also the totals for finished orders, as well as the actual composition of costs on every unit completed. Thus, if we wanted to know what cost elements were involved in one unit of the product on Production Order 131, reference to the master cost sheet would show the following:

Materials	$ 6.26
Direct Labor	.85
General Overhead	.24
Machine Burden	3.07
	$10.42

Such unit costs are of inestimable value. Not only will they aid in establishing production standards, but they will also help materially in making accurate estimates for future orders.

The master cost sheet may give even further analysis if departmental costs are shown. The analysis of departmental unit costs makes it possible to trace variations in costs to each department, for it may be found that even tho the total costs have not increased, the departmental proportions have varied. Not only should the proper proportioning of costs exist in the various elements (materials, direct labor, and overhead), but on similar orders proper departmental proportions should be shown. For illustration, let us assume that the departmental unit costs for Parts Production Order 231, are shown on the master cost sheet as follows:

Department 1	$ 7.62
Department 2	1.58
Department 3	4.09
Total	$13.29

It may happen that the total unit costs compiled on a similar order, in the production of some previous month, were the same as the total unit costs for Production Order 175, but different departmental unit costs, such as the following, were shown:

Department 1	$ 6.94
Department 2	2.11
Department 3	4.24
Total	$ 13.29

If we compare the departmental unit costs of this order with those on Parts Production Order 231, it is

apparent that Department 1 was more efficient and operating nearer standard on this order than on Order 231. This comparison will reveal information that should localize the trouble. It is equally apparent that Departments 2 and 3 were more efficient on Parts Production Order 231 than on the previous order. Whenever necessary, reference should be made to the material cost sheets and the direct-labor cost sheets for each production order. The investigation can even be traced to the material requisitions, or the laborer's daily time reports, if necessary. Such reference will be useful in definitely locating variations from standard costs.

Accounting Uses of the Master Cost Sheet. The need for a master cost sheet for production orders of all classes in process has been pointed out. This form should be a memo form only, in order to gather certain information and figures to reconcile with the factory cost control in the general ledger. The master cost sheets (for both orders finished and in process) furnish the monthly sum total of all raw materials charged to orders. This total is compared with the monthly sum total of all raw material requisitions filed by the stores department. They also show the value of finished parts charged monthly against subassembly orders (both finished and in process) which should be compared with the monthly requisitions filed in the finished parts inventory division.

A similar comparison is provided on the master cost sheets of subassemblies for subassemblies charged to final assembly orders. The sum total of all direct labor charged to orders should be reconciled with the monthly pay rolls. The entire factory overhead charged into costs should be reconciled with the factory overhead

set up in the general books. They cannot always agree, because during some months the normal maximum of productive time will not absorb the monthly factory overhead charged in the general books, while in another month the general book charges may be less than the amounts absorbed by production orders. At the end of the year, of course, the two should agree, if normal maximum output has been maintained. At the end of each month the disagreements just mentioned can be readily reconciled.

The master cost sheets, therefore, for orders in process at the end of any month will not be used for any other than reconciliation purposes. But the master cost sheets for completed orders (the form illustrated) constitute the basis for general journal entries, i.e., for charging the various inventory accounts. As we will see later, there will be only one controlling account in the general ledger for all production orders in process; but when orders are finished, the proper inventory account must be charged and the account "Production Orders in Process" credited. Reference to Figure 37 will indicate that for parts finished it is necessary to make a journal entry from the information shown on the bottom of the form, as follows:

DEBIT—Parts Inventory Account....$3,322.76
CREDIT—Production Orders in Process....$3,322.76

When subassembly orders are completed, there will be a charge to subassemblies Inventory Account and a credit to Production Orders in Process. When final assembly orders are finished, the entry will be a charge to Finished Inventory Account, and a credit to Production Orders in Process. If at any time it is desirable to know the composition of the general ledger account,

"Production Orders in Process," the master cost sheet forms used for orders in process will yield the information. In fact, they should always agree or be reconcilable with the general ledger account. It is strongly recommended that the reconciliations be made of the total costs absorbed by the cost department in finished and in process orders with the costs reflected in the general ledger.

Summary of Procedure. The rates used to absorb the overhead of the current period are based upon statements of indirect labor and supervision, lost time, liability insurance, general departments expense, and expenses for production centers. These expenses are taken from past experience and the rates are calculated on the basis of standard or normal output. Machine reports are prepared for each separate machine, to show the actual time spent on each production order for a month. The machine-hour rate multiplied by the number of hours that a machine spends on a production order is the amount of machine burden with which that order will be charged on the master cost sheet. Figure 38 will also show how the general overhead and the machine expense is absorbed by the application of predetermined rates to the actual labor and machine time spent on each production order.

The material costs are transferred from the material cost sheet, and the labor costs are transferred from the direct-labor cost sheet to the master cost sheet. The complete cost of each production order is analyzed on the master cost sheet. The master cost sheet, then, is a summary of the costs of all production orders of the same class. The grand totals on the master cost sheet are those of completed production orders for the month.

FIGURE 38

Summary of Accounting Procedure for Application of Overhead and Compilation of Master Cost Sheet

Chapter X

ACCOUNT CLASSIFICATION FOR A MANUFACTURING BUSINESS

The classification of accounts given below is suggested as satisfactory for the ordinary manufacturing business in which the cost system follows the procedure outlined. The numbering scheme is as follows:

1. For all assets.
2. For all liabilities.
3. For the net worth section of the balance sheet.
4. For all income accounts.
5. For all expense and cost of sales accounts.

It is advisable that the general ledger be arranged so that all assets will be listed first, all liabilities second, the net worth accounts third, and that all the accounts falling into these groups be arranged according to their order on the balance sheet. By this arrangement the three groups forming the balance sheet will also form the first section of the general ledger. The second section of the general ledger will show the operating accounts and include the income and expense in proper sequence. After all adjusting and closing entries have been made, the debit or credit difference between the assets and liabilities and net worth shown in the balance sheet accounts, should be equal to the credit or debit difference between the income and expense accounts in the operating section of the ledger. If these differences are the same, the general ledger must be in balance, and the accountant has at the same

time prepared a properly arranged balance sheet and profit and loss statement.

An account classification with the number designations recommended for a typical manufacturing business and in which the subclassifications may be placed, either in the general ledger or in an analysis ledger, depending upon the number of subclassifications desired, is shown in Figure 39 on folded insert.

This classification may be subclassified further or condensed. The intention is not to convey merely a list of accounts, but a logical arrangement of accounts, such as one should expect to find on the general books of a progressive manufacturer.

Thru the use of an analysis ledger, whenever details are required, the general ledger accounts may be reduced to a minimum by confining them entirely to controlling accounts. In fact, in some instances the only accounts necessary in the general ledger will be the following:

1. ASSETS

11. CURRENT ASSETS
    111. Cash
    112. Notes Receivable
    113. Accounts Receivable
    114. Liquid Investments
    115. Inventories
    116. Advance and Deposits
    117. Capital Stock Subscriptions
12. LONG-TERM INVESTMENTS (All in one Controlling Account)
13. FIXED ASSETS (All in one Controlling Account)

FIGURE 39

Classification of Accounts

14. INTANGIBLES (All in one Controlling Account)

15. DEFERRED CHARGES (All in one Controlling Account)

2. LIABILITIES

21. CURRENT LIABILITIES
    - 211. Notes Payable
    - 212. Vouchers Payable
    - 213. Accrued Liabilities
    - 214. Accounts with Officers and Employes
    - 215. Dividends Payable

22. LONG-TERM INDEBTEDNESS (All in one Controlling Account)

23. RESERVES
    - 231. Reserve for Depreciation
    - 232. Reserve for Doubtful Notes and Accounts
    - 233. Reserve for Repairs
    - 234. Reserve for Light, Heat, and Power
    - 235. Reserve for Stores Burden
    - 236. Reserve for Factory Overhead
    - 237. Surplus Reserves

3. NET WORTH

- 311. Preferred Capital Stock (Issued)
- 312. Common Capital Stock (Issued)

32. SURPLUS (All in one Controlling Account)

4. INCOME

41. SALES (All in one Controlling Account)

42. NONOPERATING INCOME
    - 421. Discounts on Purchases
    - 422. Miscellaneous Income (Combining 422, 423, and 424 in one Controlling Account)

5. EXPENSES

51. COST OF SALES (All in one Controlling Account)
52. NONOPERATING EXPENSE
    522. Discount on Sales
    523. Interest Expense (Combining 523 and 524 in one Controlling Account)
53. SELLING EXPENSE (All in one Controlling Account)
54. ADMINISTRATIVE EXPENSE (All in one Controlling Account)

By thus reducing the accounts to a few broad general ledger controlling accounts, a clear conception of the financial status of a business, as well as the results of operation, can be gained, and a general ledger trial balance may be struck off in short order. With this condensed classification only thirty-four accounts are necessary, and yet they reflect in general all the accounts in which an executive would be interested. The current assets are separated from fixed and intangible assets and deferred charges, while the current liabilities are set out so that their relationship to current assets may be quickly discerned. Enough of the operating results are indicated to show total sales, total cost of sales, gross profit, selling and administrative expenses, financial expenses, and net profits. For all general purposes this condensed classification of controlling accounts may be considered satisfactory. Monthly statements showing the operating results and the financial condition can then be quickly prepared without waiting for details. Such statements are often of great value, even tho the detailed composition of the accounts are missing. Condensed statements are not the finality, but if they balance, the assumption that the

controlling accounts are correct is quite safe. They may then serve many useful purposes before the detailed statements of operations and financial position reach the executive offices. By all means it is necessary to back up every condensed statement with a proper analysis. This analysis is to be obtained not only from the general ledger and analysis ledger, but from the cost department as well. Every fact presented should afford an opportunity to relate that fact to factory or management policies. The problem of proper presentation of facts for executive study is a large one; in fact, so large that it must be reserved for later discussion.

Factory Expense Accounts

Factory overhead, as has been already explained, is absorbed into production by the use of predetermined departmental and production center rates. From the master cost sheets of finished and unfinished orders at the end of the month, the total amount of the burden by departments charged to production orders is obtained. But the amount of overhead absorbed may not be the amount of overhead expense actually incurred. Some accounting plan must be devised to determine the actual departmental overhead and to compare the actual with the absorbed amounts.

In the classification of accounts presented in this chapter, there is provided under "Deferred Charges" an account designated as Factory Expense. This is a controlling account with all items of factory expenditures. To analyze this account for departmental application the classification shown in Figure 40 is provided:

CLASSIFICATION OF FACTORY EXPENSE ACCOUNTS					
DEPARTMENTS		ACCOUNTS			
No.	Name	Acc't No.	Name	Acc't No.	Name
F-1	Machine Shop	01	Salaries	13	Taxes--Land and Buildings
F-2	Subassembly	02	Indirect Labor--General	14	Insurance--Building
F-3	Final Assembly	03	Indirect Labor--Oper. Depts.	15	Depreciation--Buildings
F-4	Sup'ts Office	04	Lost Time--Operating Depts.	16	Repairs--Building
F-5	Cost	05	Defective Work	17	Taxes--Personal Property
F-6	Pay Roll and Employment	06	Liability Insurance	18	Insurance--Property
		07	Office Supplies	19	Depreciation--Mach., Equip.
F-7		08	Stationery and Printing	20	Repairs--Machinery, Equip.
F-8		09	Miscellaneous Office Expense	21	Tools--Expense
F-9		10	Power Expense	22	Manufacturing Supplies
F-10	General	11	Lighting Expense	23	
		12	Heating Expense	24	
				25	Factory Expense--Unclassified

FIGURE 40

In this classification, the department number should be prefixed to the account number on all transactions entering into the accounting records. For example, the analysis of the office pay roll will show the salaries of the various departments. The salaries of the superintendent's office would be represented by F4-01. For the indirect labor of the machine shop the number would be F1-03, the letter "F" merely indicating that the item is a factory charge. If 10 pounds of rags were required in Department 3, a supply requisition should be issued and the account number to be charged would be F3-22. Referring to the classification, it will be noted that Account No. 22 represents manufacturing supplies and F3 is the final assembly department to be charged.

This classification of factory accounts may be expanded to meet the requirements of any factory. If it is desired to have a more detailed classification of lost time, for instance, the Account 04 may be subclassified as follows:

04. Lost Time
    (a) Machinery Breakdowns
    (b) Waiting for Material
    (c) Waiting for Set-up
    (d) Waiting for Tools

Likewise manufacturing supplies may be further classified thus:

22. Manufacturing Supplies
    (a) Lubricants and Cutting Compounds
    (b) Waste and Cleaning Rags
    (c) General

The accounts may also be carried from 01 to 99. With this flexibility, almost every situation that may arise may be taken care of. This departmental classification, thru the use of an analysis ledger, furnishes a means of accounting monthly for the expenses of the operating departments.

The classification of accounts presented will be used in the next chapter to show how the cost transactions are linked up with controlling accounts in the general ledger, and to show how factory expenditures are compared with the overhead absorbed thru the use of predetermined rates.

Chapter XI

HOW GENERAL LEDGER ACCOUNTS CONTROL COSTS

Accounts Necessary. In the general ledger, cost control is made possible by means of inventory accounts and by the Cost of Sales Account. The only accounts necessary in the general ledger to fully reflect the costs of production and cost of sales for the cost procedure outlined in the preceding chapters are the following:

No. of Account	Name of Account
1151	Raw Materials
1152	Manufacturing Supplies
1153	Finished Parts
1154	Subassemblies
1155	Finished Product
1156	Production Orders in Process
151	Factory Expense
236	Reserve for Factory Overhead (analyzed by operating departments)
511	Cost of Sales of Finished Product (analyzed by commodities)

In order to demonstrate the accounting procedure necessary to accurate cost control in the general ledger, we will explain each amount, itemize the various charges and indicate their origin. The function of the distribution to proper control accounts is centered in two records:

1. The Voucher Register (for all payments)
2. The Cost Journal (for all journal entries pertaining to operations)

The Voucher Register. The voucher register records all vouchers for payment in one place, thereby furnishing a self-balancing posting medium for all payable items. Figure 41 presents a condensed form of voucher register, providing columns for all control accounts. Each column is provided with one subcolumn for account number and another for value. The following columns of the voucher register require analysis:

1. RAW MATERIAL. If split control of raw material is desired for each material such as pig iron, bar iron, raw castings, crude rubber or fabrics, it would be preferable to exercise this thru ledger numbers. For example, stores ledger No. 1 may be a record of all kinds of raw castings, and stores ledger No. 2 may include all kinds of fabrics. The split controlling account of raw castings will then control ledger No. 1 and the Fabrics Account will control ledger No. 2. Purchased parts may also be controlled in another ledger, such as ledger No. 3.

It is necessary only to record in the voucher register for every entry the number of the ledger. At the end of the month the "raw material" column in the voucher register is footed and analyzed according to ledger numbers. Thus the analysis of the "raw material" column in Figure 41 may show:

Raw castings . .	$3,865.85	Detailed accounts in stores ledger 1
Fabrics.	1,285.20	Detailed accounts in stores ledger 2
Purchased Parts.	1,637.10	Detailed accounts in stores ledger 3
	$6,788.15	

From this analysis, the Raw-Material Controlling Account shown above may be debited in the general ledger with the proper amounts.

The Blank Manufacturing Co.
Chicago, Ill.

VOUCHER REGISTER

No. ——

Month of January 19——

Date	Description	Voucher No.	Paid by Check No.	CREDIT: Vouchers Payable	DEBITS: Inventories: Raw Material		Manufacturing Supplies		Production Orders in Proc.		Factory Expense		Selling		Administrative and General		General Ledger		
					Ledger No.	Value	Ledger No.	Value	Acct. No.	Value	Acct. No.	Value	Acct. No.	Value	Acct. No.	Value	Acct. No.	√	Value
2	A.B.& Co.	1	5	$ 250.00	1	$ 250.00													
3	N.Y.C.R.R. (Freight)	2	4	10.85			1	$ 10.85											
3	X.Y.Co.	3	6	425 00	2	425.00													
5	E.D.Co.	4	10	680.00			1	680.00											
6	G.H.Co.	5	12	45.00							F5-07	$ 15.00	537	$ 20.00	547	$ 10.00			
8	X.Y.Insurance Co.	6	15	1,280.00													152		$ 1,280.00
10	Factory Payroll	7	3	5,125.50					a	$2,312.50	√	712.50					2331 2332 234 235		100.00 400.00 1,100.00 500.00
12	N.Y.C.R.R. Co.	8	7	18.55	1	18.55													
14	E.D.Co.	9	11	992.75	1	992.75													
15	Office Payroll	10	13	6,000.00							01	300.00	531 532	1,000.00 1,800.00	541 542	900.00 1,400.00	234 235		200.00 100.00
24	Factory Pay Roll	20	16	5,108.00					a	2,308.00	√	1,170.00					2331 2332 234 235		110.00 25.00 1,115.00 480.00
25	A.C.Coal Co.	21	18	1,000.00			2	1,000.00											
28	X.Y.Co.	22	17	812.00	2	812.00													
29	N.Y.C.R.R.	23	16	12.85	2	12.85													
31	Office Pay-Roll	24	14	6,100.00							01	350.00	531 532	1,000.00 1,850.00	541 542	900.00 1,700.00	234 235		200.00 100.00
31	Tax Collector	25	19	1,800.00													2133		1,800.00
	Totals			$41,333.15		$6,788.10		$4,205.60		$6,036.40		$2,252.60		$6,780.00		$5,175.25			$10,095.20

To control certain sections of the storeroom in this manner requires that the voucher clerk use care in recording the entries in the voucher register so that the charge to the proper ledger is made. The receiving clerk's certificate, which should be attached to the invoice for vouchering, should designate the storeroom or section to which the goods were delivered. Consequently, no difficulty should be experienced in charging the materials to the proper stores ledger on the voucher register. For every invoice vouchered and entered in the voucher register, it will be noted that the stores ledger clerk has already charged the proper material accounts in the stores ledger.

If it is desirable to control thru split controlling accounts certain classes of manufacturing supplies, it may be done in the same way as described for raw materials.

2. Production Orders in Process. All invoices for payment properly chargeable to Production Orders in Process Controlling Account are recorded in the column of the voucher register provided for this account, and an analysis of these charges may be made, if desired, at the close of the month somewhat as follows:

(a) Direct Labor
(b) Direct Expense (including supplies and other charges directly chargeable to production orders).
(c) Direct Material (materials purchased for specific orders which are charged directly to the orders rather than to Raw Materials Inventory).

In the case of the factory pay roll an analysis of the activities of each department has been explained in Chapter V. The departmental pay roll summaries are brought into a summary of all pay rolls. A copy

of this pay-roll summary should be attached to the pay roll voucher. The direct labor is recorded in the "production orders in process" column and the indirect labor is recorded in the "factory expense" column. All labor of the storeroom and the power house will be charged to Reserve for Stores Burden and Reserve for Light, Heat and Power, respectively, the pay-roll analysis of such labor determining the proper charges to each reserve account.

3. FACTORY EXPENSE. Any voucher which has a charge to Factory Expense should show a detail distribution of the charge made on it, or attached to it, according to the factory expense classification explained in Chapter X. It may happen that the detail charges by departments will be too numerous to record in the account column of the voucher register. If this is the case, the total charge to Factory Expense may be recorded in the "factory expense" column and in the account column a check (√) will indicate that a further analysis of this item by departments is to be obtained from the voucher. The voucher in every case should provide for the departmental charges. At the close of each month an analysis of the total of the "factory expense" column should be made departmentally according to the expense classification. This analysis must check with the total of the "factory expense" column.

4. SELLING EXPENSE. In this column is entered all selling expense accounts. At the end of each month an analysis of all entries in this column may be made in an analysis ledger or on an analysis sheet which provides columns for the various subclassifications of selling expense. This analysis must, of course, agree with the

total of the "selling expense" column which is posted to the debit of Selling Expense Controlling Account in the general ledger.

5. Administration and General. This column may also be analyzed in an analysis ledger to show detailed expense accounts, the total of which must agree with the sum of all items in this column.

6. General Ledger. In this column are entered charges to all accounts for which no special column has been provided. If an analysis of any account is desired, the details should be obtained from the vouchers.

Cost Journal. The cost journal is a record of all journal entries for the operating transactions of the business. Transactions not only of the factory but of the selling and administrative divisions of the business are journalized in the cost journal. Journal entries for nonoperating transactions such as the issue of bonds or the declaration of a dividend are entered in the general journal. Thus the general journal is confined to extraordinary transactions that do not affect the operating expenses and income while the cost journal localizes all entries pertaining to cost operations and makes their identification easy.

Figure 42 is suggestive. On this form are closing transactions which furnish a means by which general ledger accounts control costs. As in the case of the voucher register, a check (√) in the account column indicates that the analysis is to be obtained from the journal voucher.

For every journal entry it is recommended that a journal voucher be used. On the journal voucher the

Sheet No. 10

COST JOURNAL

Month of.............19......

DEBITS: Factory Expense Acct. No.	DEBITS: Factory Expense Value	DEBITS: Selling Acct. No.	DEBITS: Selling Value	DEBITS: Administrative & General Acct. No.	DEBITS: Administrative & General Value	DEBITS: General Ledger Acct. No.	DEBITS: General Ledger Fol.	DEBITS: General Ledger Value	Explanation: Jol. Vo. No.	Explanation: Name	CREDITS: General Ledger Acct. No.	CREDITS: General Ledger Fol.	CREDITS: General Ledger Value	CREDITS: Accounts Rec. Acct. No.	CREDITS: Accounts Rec. Value	CREDITS: Vouchers Payable Acct. No.	CREDITS: Vouchers Payable Value	CREDITS: Acct. No.	CREDITS: Value
			$175.00		$208.00			$ 4,000.00		Totals Forwarded			$ 3,625.00		$410.00		$348.00		
						1151		98.30											
						1152		41.55	1	Stores Burden on Mat'l, Supplies	235		139.85						
						1156		3,988.50											
	310.00					2331		28.00	2	Materials Used	1151		3,988.50						
						2332		32.00											
						234		660.00	2	Supplies Used	1152		1,105.00						
						235		75.00	2										
						234		16.50											
	97.00	537	3.67	548	6.00	235		5.00	3	Building Repairs	2331		128.17						
						234		41.67			2332		176.25						
	128.41	537	2.00	548	4.00	235		10.00	4	Repairs to Mach., Equip., Fixt.	2333		9.83						
	2,269.44	537	9.01	548	18.03	235		21.85	5	Light, Heat, and Power	234		2,318.33						
						234		46.67											
	229.17	537	5.83	548	11.67	235		8.33	6	Depreciation--Buildings	2311		301.67						
						234		100.00			2312		1,183.34						
	1,071.67	537	20.83	548	49.16	235		16.67	7	Deprec. Machy. and Equip.	2313		74.99						
						234		20.83											
	203.33	537	4.00	548	6.50	235		7.67	8	Taxes--Real Estate	2133		242.33						
						234		62.50											
	175.42	537	3.33	548	5.00	235		3.75	9	Taxes--Personal Property	2133		250.00						
						234		9.33											
	90.00	537	2.00	548	2.67	235		2.67	10	Insurance Expired--Buildings	152		106.67						
						234		33.33											
	93.83	537	1.50	548	2.67	235		2.00	11	Insurance Expired--Property	152		133.33						
	30.00	537	50.00			235		120.00	12	Insurance Expired--Stock	152		200.00						
						234		10.00											
	248.25	537	6.00	548	8.00	235		5.00	13	Insurance, Liability	152		277.25						
F1.05	100.00					1152		12.00	14	Defective Work	1156		112.00						
						1156		3,251.11	15	Dept. Overhead absorbed	2361		3,251.11						
						1153		3,322.76	16	Parts Finished	1156		3,322.76						
						1153		16.61	17	Stores Burden on Parts Finished	235		16.61						
						1156		2,482.75	18	Parts issued	1153		2,482.75						
						1156		2,410.07	19	Dept. 2 Overhead Absorbed	2362		2,410.07						
						1154		4,989.88	20	Subassemblies Finished	1156		4,989.88						
						1154		29.93	21	Stores Burden on Subassemblies	235		29.93						
											1154		4,008.00						
						1156		4,182.10	22	Parts and Subassemblies Used	1153		174.10						
						1156		1,448.10	23	Dept. 3 Overhead Absorbed	2363		1,448.10						
						1155		5,680.25	24	Goods Finished	1156		5,680.25						
						2361		3,341.50											
						2362		2,481.73											
						2363		1,475.89	25	Redistributing Factory Expense	151		7,299.12						
						511		4,692.40	26	Cost of Goods Sold	1155		4,692.40						
	$5,046.62		$283.17		$321.70			$49,284.20		Totals			$54,177 59		$410.00		$348.00		

distribution of expense items should be made, and any papers or statements supporting the entry should be attached to the journal voucher. The journal vouchers filed consecutively by journal voucher numbers furnish a ready reference at any time for all details.

In order to illustrate the entries that link up the general ledger accounts with the cost records, we will take the transactions for one month and show the entries in journal entry form together with the sources of information for the analysis of factory expense.

Purchase of Raw Materials and Supplies. Raw materials and supplies purchased are entered in the stores ledger, which has already been explained. The invoices are vouchered and entered in the voucher register as a debit to Raw Materials or Manufacturing Supplies, as the case may be, and a credit to Vouchers Payable. Freight paid is handled in the same manner. At the end of the month the totals of the "raw material" and "manufacturing supplies" columns are posted to the respective controlling accounts in the general ledger. The postings from the voucher register summary will be shown later.

If split controlling accounts are in use a further analysis of these debits is necessary.

Reserve for Stores Burden. It has been recommended that stores burden be charged to the purchases based upon a predetermined percentage of the average annual stores expenditures to the normal purchases. Since this percentage must be applied to the invoice cost of purchases, it is necessary to find out from the entries in the voucher register how much of each of the

totals of the "raw material" and "manufacturing supplies" columns is freight expense. The freight expense must then be deducted from these totals in order to base the percentage of stores burden upon the actual invoice cost for the month. If the percentage of stores expense is 1 per cent for raw materials and supplies, the following entry will be made at the close of the month in the cost journal:

(Journal Entry 1)

1151. Raw Materials.	$98.30	
1152. Manufacturing Supplies	41.55	
235--Reserve for Stores Burden . . .		$139.85
To record the amount of stores burden to be charged to raw materials for the month of January.		

If in any case freight cannot be directly allocated to commodity accounts in the stores ledgers, the annual freight expenditures may be estimated and included in the budget of stores expense. It will then form a part of the computation for stores burden. In this case the freight bills will not be charged to inventory accounts in the voucher register but to the Reserve for Stores Burden.

Whenever raw materials and supplies are purchased for specific production orders, they may not enter the storerooms but may be used immediately on production orders. In such a case the vouchers are entered in the "production orders in process" column of the voucher register and charged on the material cost sheets to the proper production orders.

Material Requisitions. No raw material is delivered from the storeroom unless a material requisition is filled out and properly approved. The requisitions must show the production order number, the quantity,

and the kind of material. These requisitions are posted to the credit of the stores ledger accounts and to the debit of the production orders for which the material is used, on the respective material cost sheets. Likewise, supply requisitions should show the quantity, kind of material, and the account to which they are charged. If the machine shop orders supplies for general use, the supply requisition should show the account, as for example, Account No. F1-22, a factory expense classification explained in the previous chapter. If material is requisitioned for repairing the machine shop building, the account to be charged would be Account No. 2331-a, Reserve for Repairs of Buildings, "a" indicating the building code. Quite frequently repair orders are used. All material, labor and expenses are charged to the repair order. When completed, the repair order is charged to the Reserve Account. Repair orders will be explained fully in a later chapter.

Likewise all requisitions for supplies used in the power house should show the charge to Account No. 234, Reserve for Light, Heat and Power.

A summary of all raw material and supply requisitions is made at the close of the month. We will assume the following totals:

Charges to Production Orders	$3,988.50
Supplies Charged to Factory Departments	310.00
Repair Materials--Buildings	28.00
Repair Materials--Machinery and Equipment	32.00
Power House Supplies	660.00
Supplies used in Storerooms	75.00

A journal voucher may now be prepared showing the distribution in detail. The voucher may be entered in the cost journal. It is shown in Journal Entry 2.

(Journal Entry 2)

1156. Production Orders in Process	$3,988.50	
151. Factory Expense.	310.00	
2331. Reserve for Repairs--Buildings and Equipment.	28.00	
2332. Reserve for Repairs--Machinery and Equipment.	32.00	
234. Reserve for Light, Heat and Power. .	660.00	
235. Reserve for Stores Burden.	75.00	
1151--Raw Materials.		$3,988.50
1152--Manufacturing Supplies.		1,105.00

To record the materials and supplies used for the month of January, as per summary of material requisitions.

All entries to Factory Expense Account must be analyzed. The Analysis of Factory Expense, Figure 44, will be used for this purpose. The summary of material requisitions which is attached to the journal voucher, we will assume, shows the following departmental distribution of factory expense:

F1.21. . . .	$ 8.00	F1.22 . . .	$112.00
F2.21. . . .	7.00	F2.22 . . .	66.00
F3.21. . . .	5.00	F3.22 . . .	47.00
		F10.22. . .	65.00
	$20.00		$290.00

These items will be recorded on the Analysis of Factory Expense and distributed to the various factory departments.

Pay-Roll Distribution. The pay-roll summary, Figure 16, is the source of the data to tie up labor costs with the general ledger accounts. It is necessary only to point out here that after an analysis of the pay roll of each department is completed a voucher is prepared and entered in the voucher register, the details being shown on the pay-roll summary, the debit and credits on the voucher being as follows:

1156. Production Orders in Process (for all direct labor).
151. Factory Expense (for all indirect labor and salaries and wages of general departments).
2331. Reserve for Repairs--Buildings (for repair labor).
2332. Reserve for Repairs--Machinery and Equipment (for repair labor).
234. Reserve for Light, Heat, and Power (for salaries and wages of power house).
235. Reserve for Stores Burden (for salaries and wages of storerooms).
212. Vouchers Payable.

Repairs. It has already been advocated that reserves should be created for repairs so that each month's costs will bear an equal proportion of the burden. If we refer to the annual budget, Figure 21, and Schedule 8, page 116, we will then have the basis of an entry in the cost journal for one-twelfth of the annual estimate. After analyzing the repairs of the office building so that the general factory—the selling and administrative functions—bear their proportion, we have the monthly entry for repairs to buildings as shown in Journal Entry 3.

(Journal Entry 3)

234.	Reserve for Light, Heat, and Power . . .	$16.50	
235.	Reserve for Stores Burden.	5.00	
151.	Factory Expense.	97.00	
537.	Miscellaneous Selling Expenses	3.67	
548.	Miscellaneous General Expenses	6.00	
	2331. Reserve for Repairs of Buildings. . . .		$128.17

To record one-twelfth of the annual estimated repairs, as per budget.

The journal voucher for this entry will show the analysis of factory expense to be recorded on Figure 44 as follows:

F1.16...........	$30.00
F2.16...........	40.00
F3.16...........	20.00
F4.16...........	.....
F5.16...........	.....
F6.16...........	7.00
	$97.00

The repairs to machinery and equipment are also journalized monthly by taking one-twelfth of the amounts set up in the annual budget in Figure 21, as shown in Journal Entry 4.

(Journal Entry 4)

234.	Reserve for Light, Heat, and Power	$ 41.67	
235.	Reserve for Stores Burden	10.00	
151.	Factory Expense	128.41	
537.	Miscellaneous Selling Expense	2.00	
548.	Miscellaneous General Expense	4.00	
	2332. Reserve for Repairs--Machinery and Equipment		$176.25
	2333. Reserve for Repairs--General		9.83

To record one-twelfth of the annual estimated repairs as per budget.

The analysis of the charge to Factory Expense to be recorded in Figure 44 is as follows:

F1.20	$ 66.67
F2.20	31.25
F3.20	26.66
F4.20, F5.20, F6.20	3.83
	$128.41

Light, Heat, and Power. The monthly entry in the cost journal analyzed from the annual budget, as in Journal Entry 5:

(Journal Entry 5)

151.	Factory Expense	$2,269.44	
235.	Reserve for Stores Burden	21.85	
537.	Miscellaneous Selling Expense	9.01	
548.	Miscellaneous General Expense	18.03	
	234. Reserve for Light, Heat, and Power		$2,318.33

To record one-twelfth of the annual estimated amount of light, heat and power, as per budget.

The analysis of the factory expense on the journal voucher will show the following:

F1.10	$985.29
F2.10	591.18
F3.10	394.11
Power Expense	$1,970.58
F1.11	$ 57.96
F2.11	72.45
F3.11	57.95
F4.11, F5.11, F6.11	11.60
Lighting Expense	199.96
F1.12	$34.50
F2.12	39.10
F3.12	18.40
F4.12, F5.12, F6.12	6.90
Heating Expense.	98.90
	$2,269.44

Depreciation. From the depreciation used in connection with the budget of factory expenditures journal entries may be prepared for one-twelfth of the annual amounts, as in Journal Entry 6.

(Journal Entry 6)

151.	Factory Expense	$229.17	
234.	Reserve for Light, Heat, and Power.	46.67	
235.	Reserve for Stores Burden	8.33	
537.	Miscellaneous Selling Expense	5.83	
548.	Miscellaneous General Expense	11.67	
	2311. Reserve for Depreciation--Buildings.		$301.67

To record one-twelfth of the annual depreciation for the year as per depreciation schedule and budget.

The details shown on the journal voucher for factory expense are as follows:

F1.15	$ 66.67
F2.15	100.00
F3.15	50.00
F4.15, F5.15, F6.15	12.50
	$229.17

(Journal Entry 7)

151.	Factory Expense	$1,071.67	
234.	Reserve for Light, Heat, and Power.	100.00	
235.	Reserve for Stores Burden	16.67	
537.	Miscellaneous Selling Expense	20.83	
548.	Miscellaneous General Expense	49.16	
	2312. Reserve for Depreciation of Machinery and Equipment.		$1,183.34
	2313. Reserve for Depreciation of Office Furniture and Fixtures.		74.99

To record one-twelfth of the annual depreciation of machinery, equipment, office furniture, and fixtures, as per depreciation schedule and budget.

The details of the charge to Factory Expense are shown on the journal voucher as follows:

F1.19	$ 583.34
F2.19	250.00
F3.19	233.33
F4.19, F5.19, F6.19	5.00
	$1,071.67

Taxes. The estimated taxes for the current year have been included in the budget. It is necessary to prepare a journal entry monthly, as in Journal Entry 8.

(Journal Entry 8)

151.	Factory Expense	$203.33	
234.	Reserve for Light, Heat, and Power.	20.83	
235.	Reserve for Stores Burden	7.67	
537.	Miscellaneous Selling Expense	4.00	
548.	Miscellaneous General Expense	6.50	
	2133. Accrued Taxes.		$242.33

To record one-twelfth of the estimated real estate tax for the year, as per Schedule 3, Figure 27.

The details of the charge to Factory Expense are shown in the journal voucher as follows:

F1.13	$ 62.50
F2.13	89.17
F3.13	44.16
F4.13, F5.13, F6.13	7.50
	$203.33

(Journal Entry 9)

151.	Factory Expense	$175.42	
234.	Reserve for Light, Heat, and Power	62.50	
235.	Reserve for Stores Burden	3.75	
537.	Miscellaneous Selling Expense	3.33	
548.	Miscellaneous General Expense	5.00	
	2133. Accrued Taxes		$250.00

To record one-twelfth of the personal property tax, as per Schedule 4, Figure 28.

The details of the charge to Factory Expense on the journal voucher are shown as follows:

F1.17	$ 93.75
F2.17	40.00
F3.17	37.50
F4.17, F5.17, F6.17	4.17
	$175.42

Insurance. From the insurance register in connection with the annual budget of factory expenditures the amount of insurance expired for the month can be ascertained. Differences between the actual insurance expired and the amounts set up in the budget may be due to cancellations of insurance policies at short rates or to additional insurance. However, the management can plan the insurance to be carried and thereby reduce such differences to a minimum. Assuming that no differences exist, we will set up the monthly entries, as in Journal Entry 10.

(Journal Entry 10)

151.	Factory Expense	$90.00	
234.	Reserve for Light, Heat, and Power	9.33	
235.	Reserve for Stores Burden	2.67	
537.	Miscellaneous Selling Expense	2.00	
548.	Miscellaneous General Expense	2.67	
	152. Prepaid Insurance		$106.67
	To record the insurance on buildings expired for the month of January.		

The details of the charge to Factory Expense are shown in the journal voucher as follows:

F1.14	$26.67
F2.14	40.00
F3.14	20.00
F4.14, F5.14, F6.14	3.33
	$90.00

(Journal Entry 11)

151.	Factory Expense	$93.83	
234.	Reserve for Light, Heat, and Power	33.33	
235.	Reserve for Stores Burden	2.00	
537.	Miscellaneous Selling Expense	1.50	
548.	Miscellaneous General Expense	2.67	
	152. Prepaid Insurance		$133.33
	To record the insurance on personal property expired for the month of January.		

The details of the charge to Factory Expense are shown on the journal voucher as follows:

F1.18	$50.00
F2.18	21.33
F3.18	20.00
F4.18, F5.18, F6.18	2.50
	$93.83

(Journal Entry 12)

235.	Reserve for Stores Burden	$120.00	
151.	Factory Expense (F10--18)	30.00	
537.	Miscellaneous Selling Expense	50.00	
	152. Prepaid Insurance		$200.00
	To record insurance expired on the average stock of raw materials in storeroom and in process for the month of January.		

It will be noted that the subclassification of Factory Expense is F10-18 in entry 12. The factory expense classification in Chapter X shows that F10 is a general department. Insurance expense on the average stock in process of manufacturing in the various operating departments may be charged to this classification. Insurance expense on finished stock in storage ready for shipment is an expense of selling.

Liability Insurance. The actual pay rolls for the current month are analyzed according to the rates specified in the policy and the actual liability insurance is journalized, as in Journal Entry 13.

(Journal Entry 13)

151.	Factory Expense	$248.25	
234.	Reserve for Light, Heat, and Power	10.00	
235.	Reserve for Stores Burden	5.00	
537.	Miscellaneous Selling Expense	6.00	
548.	Miscellaneous General Expense	8.00	
	152. Prepaid Insurance		$277.25

To record the liability insurance based upon the actual pay rolls for the month of January.

The details of the charge to Factory Expense are distributed as follows:

F1.06	$ 80.00
F2.06	96.00
F3.06	60.50
F4.06, F5.06, F6.06, F10.06	11.75
	$248.25

Defective Work. The cost of defective work is charged to the department in which the rejection arises. For the current month we have the following journal entry for defective work charged to the machine shop:

(Journal Entry 14)

151.	Factory Expense (F1-05)	$100.00	
1152.	Manufacturing Supplies	12.00	
	1156. Production Orders in Process		$112.00
	To record the defective work expense for the month of January.		

The material, labor, and overhead expense of the product up to the time the rejection is made must be credited to the production orders in the cost ledger. If they have a scrap value, the rejected product is put into the storeroom and carried in a stores account at the scrap value. The difference between this amount and the amount credited to the production order is charged to Defective Work.

Voucher Register Summary. The Voucher Register, Figure 41, is totaled at the end of the month and postings are made from it to the proper accounts in the general ledger. These totals are as follows:

Raw Materials		$ 6,788.10
Manufacturing Supplies		4,205.50
Production Orders in Process (analyzed as follows):		
(a) Direct Labor	$5,986.40	
(b) Direct Expense	50.00	6,036.40
Factory Expense		2,252.60
Selling Expense		6,780.00
Administrative and General		5,175.25
General Ledger accounts (individual postings to ledger accounts)		10,095.20
Vouchers Payable		$41,333.05

An analysis of the various expense accounts, the aggregate of which agrees with the total of the factory expense column in the voucher register as shown in Figure 43.

Acct. No.	NAME	DEPARTMENTS					TOTAL
		F1	F2	F3	F4, 5, 6 combined	F10	
01	Salaries.				$1,165.00		$1,165.00
02	Ind. Labor—General					$250.00	250.00
03	Ind. Labor—Operating Depts. .	$265.15	$268.25	$ 84.10			617.50
04	Lost Time	45.00	40.00	26.00			111.00
07	Office Supplies .				30.00		30.00
08	Stat. & Printing.				15.00		15.00
09	Misc. Office Exp.				42.10		42.10
21	Tools Expense . .	12.00					12.00
25	Unclassified. . .					10.00	10.00
	Totals.	$322.15	$308.25	$110.10	$1,252.10	$260.00	$2,252.60

FIGURE 43.

Overhead Charges to Production Orders in Process. We have now provided for the entries charging Factory Expense Controlling Account with all of the items of expense for the current month. We must provide for a plan of charging the overhead absorbed into production thru the use of predetermined departmental and machine-hour rates.

The cost department tabulates all costs by production orders and all orders finished during the month are summarized on master cost sheets similar to Figure 37. Master cost sheets will also be prepared for orders in process at the end of the month which will show the amount of overhead applicable to the uncompleted orders at that time.

From the master cost sheet of parts production orders completed, as shown in Figure 37, it will be noted that the overhead absorbed consists of the following:

General Overhead . .	$ 439.50
Machine Burden . . .	950.04
	$1,389.54

From the master cost sheets of parts production orders in process at the end of the month we will assume the following overhead costs are obtained:

General Overhead . .	$ 615.13
Machine Burden . . .	1,246.44
	$1,861.57

We are now ready to make a journal entry in the cost journal, as in Journal Entry 15.

(Journal Entry 15)

1156. Production Orders in Process. . . .$3,251.11
    2361. Reserve for Factory Overhead
        Dept. 1. . . . .$3,251.11

To record the overhead absorbed into parts production during the month of January.

Finished Parts. As parts are finished and placed in the finished-parts storeroom, the Stores Ledger Accounts with the various part numbers will be debited with the factory cost plus the stores burden. These transactions will be reflected in the controlling accounts, as in Journal Entry 16.

(Journal Entry 16)

1153. Finished Parts. $3,322.76
    1156. Production Orders in Process $3,322.76

To record the cost of parts finished as per master cost sheet, for the month of January.

(Journal Entry 17)

1153. Finished Parts. $16.61
    235. Reserve for Stores Burden $16.61

To record the stores burden on parts finished and placed into stock, based upon ½ of 1% of the factory cost for the month of January.

Sub Assemblies. When the finished parts are delivered to the subassembly department, a material requisition must be issued. The price at which each part is charged to material cost sheets for subassembly orders will be the factory cost plus the stores burden. The finished parts then become the material cost on the subassembly orders. As the parts are thrown into process again, the summary of material requisitions for the month charged to subassembly orders is the basis for Journal Entry 18.

(Journal Entry 18)

```
1156. Production Orders in Process. . . .$2,482.75
      1153. Finished Parts . . . . . . . . . . . . .$2,482.75

      To record the parts issued from
      finished-parts storeroom during the
      month of January, as per summary of
      material requisitions.
```

The overhead absorbed into the production of subassemblies for both finished and unfinished orders may be obtained from the master cost sheets as follows:

General Overhead	$1,127.52
Production Center Burden	1,282.55
	$2,410.07

An entry in this cost journal will show as in Journal Entry 19.

(Journal Entry 19)

```
1156. Production Orders in Process. . . .$2,410.07
      2362. Reserve for Factory Overhead
                Dept. 2. . . . . . . . . . . . . .  $2,410.07

      To record the overhead absorbed by
      the subassembly department during
      the month of January.
```

From the master cost sheet of subassembly orders finished Journal Entry 20 will be made.

(Journal Entry 20)

```
1154. Subassembly Inventory . . . . . . .$4,989.88
      1156. Production Orders in Process . . . . .$4,989.88

      To record the cost of subassemblies
      completed as per master cost sheets.
```

The stores burden will be journalized as in Journal Entry 21.

(Journal Entry 21)

```
1154. Subassembly Inventory . . . . . . .$29.93
      235. Reserve for Stores Burden . . . . . $29.93

      To record the stores burden on sub-
      assemblies placed in stock during
      January, based upon 6/10 of 1% of
      factory cost.
```

Final Production. The subassemblies are delivered out of the storeroom on material requisitions which show the final assembly production orders on which the material is used. Quite often parts as well as subassemblies are used in the final assembly. Consequently a summary of material requisitions for material used on final assembly orders will be journalized as in Journal Entry 22.

(Journal Entry 22)

```
1156. Production Orders in Process. . . .$4,182.10
      1154. Subassembly Inventory. . . . . . . . .$4,008.00
      1153. Finished Parts . . . . . . . . . . . .   174.10

      To record the subassemblies and
      finished parts charged to final as-
      sembly production orders during the
      month of January, as per summary of
      material requisitions.
```

From the master cost sheets of final assembly orders finished and unfinished the overhead absorbed by the final assembly department may be summarized as in Journal Entry 23.

(Journal Entry 23)

```
1156. Production Orders in Process. . . .$1,448.10
      2363. Reserve for Factory Over-
                head, Dept. 3. . . . . . . . . . . .$1,448.10

      To record the overhead absorbed by
      the Final Assembling Department.
```

When the finished product is completed it is placed in the finished goods stock room. From the master cost sheet of final assembly production orders completed, an entry in the cost journal will be made, as in Journal Entry 24.

(Journal Entry 24)

```
1155. Finished Product. . . . . . . . . . . $5,680.25
      1156. Production Orders in Process . . . . .$5,680.25

      To record the factory cost of goods
      finished and placed in stock room
      for shipment during January, as per
      master cost sheet of final produc-
      tion orders completed.
```

Factory Expense Analysis. The analysis of all charges to Factory Expense for the month is obtained from the journal vouchers and the vouchers payable. The cost journal and the voucher register in most cases will not show all the details for analysis, due to the lack of space. Consequently the analysis must be obtained from the vouchers, the "factory expense" columns of the cost journal and the voucher register being used as guides to the proper charges which must be analyzed. The form shown in Figure 44 is suggestive of the way in which all the expense items may be analyzed for the various control accounts, such as Factory Expense, Selling Expense, and Administrative Expense:

It will be noted that all the journal vouchers and vouchers payable which have items chargeable to Factory Expense are summarized in this statement so

ANALYSIS OF FACTORY EXPENSE

Month of January, 19

TOTAL	Source of Entry	DEPARTMENTS F1 Acct. No.	F1 Value	F2 Acct. No.	F2 Value	F3 Acct. No.	F3 Value	F4, 5, 6 Acct. No.	F4, 5, 6 Value	F10 Acct. No.	F10 Value
$ 310.00	J. V. 2	21	$ 8.00	21	$ 7.00	21	$ 5.00			22	$ 65.00
		22	112.00	22	66.00	22	47.00				
97.00	J. V. 3	16	30.00	16	40.00	16	20.00	16	$ 7.00		
128.41	J. V. 4	20	66.67	20	31.25	20	26.66	20	3.83		
2,269.44	J. V. 5	10	985.29	10	591.18	10	394.11				
	J. V. 5	11	57.96	11	72.45	11	57.95	11	11.60		
	J. V. 5	12	34.50	12	39.10	12	18.40	12	6.90		
229.17	J. V. 6	15	66.67	15	100.00	15	50.00	15	12.50		
1,071.67	J. V. 7	19	583.34	19	250.00	19	233.33	19	5.00		
203.33	J. V. 8	13	62.50	13	89.17	13	44.16	13	7.50		
175.42	J. V. 9	17	93.75	17	40.00	17	37.50	17	4.17		
90.00	J. V. 10	14	26.67	14	40.00	14	20.00	14	3.33		
93.83	J. V. 11	18	50.00	18	21.33	18	20.00	18	2.50		
30.00	J. V. 12									18	30.00
248.25	J. V. 13	06	80.00	06	96.00	06	60.50	06	11.75		
100.00	J. V. 14	05	100.00								
1,165.00	V. R.							01	1,165.00		
250.00	V. R.									02	250.00
617.50	V. R.	03	265.15	03	268.25	03	84.10				
111.00	V. R.	04	45.00	04	40.00	04	26.00				
30.00	V. R.							07	30.00		
15.00	V. R.							08	15.00		
12.00	V. R.	21	12.00								
10.00	V. R.									25	10.00
42.10	V. R.							09	42.10		
$7,299.12	Totals		$2,679.50		$1,791.73		$1,144.71		$1,328.18		$355.00

FIGURE 44.

that account numbers and the amounts for each factory department are shown. The sum of the totals to factory departments, on this statement must agree with the aggregate charges to Factory Expense in the cost journal and the voucher register. It is the work of the cost clerk to make this analysis.

From this expense analysis the accounts may be summarized for each factory department. Mechanical devices, such as an adding machine or a comptometer, are a convenient aid for this purpose. As a result of this summary a Departmental Factory Overhead Statement, such as Figure 45, for the month may be prepared.

DEPARTMENTAL FACTORY OVERHEAD

Month of January, 19__

Factory Expense Cr.	Account		Operating Departments			General Departments
	No.	Name	Dept. 1	Dept. 2	Dept. 3	
$1,165.00	01	Salaries				$ 1,165.00
250.00	02	Ind. Labor General				250.00
617.50	03	Ind. Labor Oper. Depts.	$ 265.15	$ 268.25	$ 84.10	
111.00	04	Lost Time	45.00	40.00	26.00	
100.00	05	Defective Work	100.00			
248.25	06	Liability Insurance	80.00	96.00	60.50	11.75
30.00	07	Office Supplies				30.00
15.00	08	Stationery & Printing				15.00
42.10	09	Misc. Office Expense				42.10
1,970.58	10	Power Expense	985.29	591.18	394.11	
199.96	11	Lighting Expense	57.96	72.45	57.95	11.60
98.90	12	Heating Expense	34.50	39.10	18.40	6.90
203.33	13	Taxes, Land & Bldgs.	62.50	89.17	44.16	7.50
90.00	14	Insurance, Bldgs.	26.67	40.00	20.00	3.33
229.17	15	Depreciation, Bldgs.	66.67	100.00	50.00	12.50
97.00	16	Repairs, Bldgs.	30.00	40.00	20.00	7.00
175.42	17	Taxes, Pers. Property	93.75	40.00	37.50	4.17
123.83	18	Insurance, Property	50.00	21.33	20.00	32.50
1,071.67	19	Depreciation--Mach. & Equip.	583.34	250.00	233.33	5.00
128.41	20	Repairs, Mach. & Equip.	66.67	31.25	26.66	3.83
32.00	21	Tools Expense	20.00	7.00	5.00	
290.00	22	Manufacturing Supplies	112.00	66.00	47.00	65.00
10.00	25	Unclassified				10.00
		Totals	$2,679.50	$1,791.73	$1,144.71	1,683.18
		General Departments Expense Redistributed	662.00	690.00	331.18	*1,683.18
$7,299.12		GRAND TOTALS	$3,341.50	$2,481.73	$1,475.89	

*Denotes deduction

FIGURE 45.

The total of the expense items chargeable to general departments must be redistributed to the operating departments. In the budget, this distribution was made on the basis of the total average labor hours of these departments. In the monthly statement of factory overhead the general departments expense is redistributed on the basis of the actual labor hours (direct and indirect) for the month. If the labor hours obtained from the pay-roll summaries show 4,800 hours for Department 1, 5,000 hours for Department 2, and 2,400 hours for Department 3, the general departments expense is distributed 48/122 to Department 1, 50/122 to Department 2, and 24/122 to Department 3.

After the total overhead of each department has been ascertained, an entry may be made in the cost journal, as follows:

(Journal Entry 25)

2361. Reserve for Factory Overhead--Dept. 1.	$3,341.50	
2362. Reserve for Factory Overhead--Dept. 2.	2,481.73	
2363. Reserve for Factory Overhead--Dept. 3.	1,475.89	
151 Factory Expense		$7,299.12

To record the actual departmental overhead as per statement of factory overhead for the month of January.

The amount of overhead absorbed into production thru the use of predetermined rates has already been credited to these reserve accounts. The credits to these reserves consequently control the amount of overhead at standard rates which is applied to production orders. The charges to these reserves represent the overhead expense as it actually occurs. The difference between the debits and the credits in the departmental reserve will represent overabsorbed burden if a credit balance, and underabsorbed burden if a debit balance.

In order to leave the charges to these reserves free for adjustments and to accumulate each month the actual overhead incurred as the fiscal year goes on, it may be advisable to charge departmental overhead accounts rather than the reserve accounts, and to close these accounts into the reserves at the end of the year. Even tho the charges were made to departmental overhead accounts, the amounts of actual overhead can be brought together with the corresponding reserves at the end of the month only for the preparation of statements.

Underabsorbed or Overabsorbed Burden Explained. Since we have an analysis of the actual overhead of a department for the month, we can prepare a statement showing the increases or decreases of actual over standard expense, not only for the month but for the cumulative period from the beginning of the year to the end of the current month. The statement for the machine shop is illustrated in Figure 46.

In this statement we have taken one-twelfth of the items in the annual budget, Figure 21, and compared them with the actual expenses of the machine shop. Any increases or decreases must be investigated. These are compared with the increases and decreases of the actual over the standard expenses. If some item of expense is gradually increasing from month to month, it may be due to the fact that the estimate set up in the budget is incorrect. It may be necessary to readjust this estimate and thereby change the predetermined rate so that the overhead expense will be absorbed during the current year.

This statement also shows that the overhead charged to production orders did not absorb the standard ex-

DEPARTMENT 1—MACHINE SHOP

Month of January, 19__

Account		Current Month			Cumulative—One Month		
No.	Name	Actual Expense	Standard Expense	Increase or Decrease	Actual Expense	Standard Expense	Increase or Decrease
03	Indirect Labor	$ 265.15	$ 250.00	$ 15.15	$ 265.15	$ 250.00	$ 15.15
04	Lost Time.	45.00	40.00	5.00	45.00	40.00	5.00
05	Defective Work	100.00	55.83	44.17	100.00	55.83	44.17
06	Liability Insurance. . . .	80.00	83.33	3.33*	80.00	83.33	3.33*
	Gen. Department's Exp. . .	662.00	666.67	4.67*	662.00	666.67	4.67*
10	Power Expense.	985.29	985.29		985.29	985.29	
11	Lighting Expense	57.96	57.96		57.96	57.96	
12	Heating Expense.	34.50	34.50		34.50	34.50	
13	Taxes--Land & Bldgs. . . .	62.50	62.50		62.50	62.50	
14	Insurance--Land & Bldgs. .	26.67	26.67		26.67	26.67	
15	Depreciation, L. & B.. . .	66.67	66.67		66.67	66.67	
16	Repairs--Buildings	30.00	30.00		30.00	30.00	
17	Taxes, Per. Property . . .	93.75	93.75		93.75	93.75	
18	Insurance--Property. . . .	50.00	50.00		50.00	50.00	
19	Depreciation--M. & E.. . .	583.34	583.34		583.34	583.34	
20	Repairs--M. & E.	66.67	66.67		66.67	66.67	
21	Tools Expense.	20.00	20.83	.83*	20.00	20.83	.83*
22	Manufacturing Supplies . .	112.00	110.00	2.00	112.00	110.00	2.00
	Totals.	$3,341.50	$3,284.01	$ 57.49	$3,341.50	$3,284.01	$ 57.49
	Factory overhead charged to Production Orders. .		$3,251.11			$3,251.11	
	Unearned Burden.		32.90			32.90	
	Increase of Actual over Standard Expense. . . .		57.49			57.49	
	Balance as per ledger Account Number 2361 . .		$ 90.39			$ 90.39	

*Decrease

FIGURE 46.

pense for the same period, because the production during the month was below normal. Reference to the Ledger Account No. 2361, at the close of this chapter will reveal the fact that there is a debit balance of $90.39. This balance is fully explained in Figure 46 and the results are:

Increase of Actual over Standard Expense.	$57.49
Unearned Burden due to production being below normal. .	32.90
Total.	$90.39

It is not advisable to close out this balance in the Reserve for Factory Overhead Account to Profit and Loss at the close of every month, because a debit balance in the account may adjust itself in the succeeding months. However, these balances should be considered in preparing the monthly operating statements.

Publicity of Costs. In many of the manufacturing concerns innumerable cost figures are compiled and stowed away. It is often thought that cost figures which have been compiled are confidential. This is a very vital mistake. The superintendent, foremen, and others will be in a better condition to improve existing conditions if cost information in their departments is available.

The head of each operating department should be provided each month with a copy of the statement of his overhead for the past month. The items of overhead in Department 1, shown in the last statement, for which the foreman of the machine shop should be held definitely responsible, may be prepared in a statement to show the actual standard and the increases and decreases not only for the current month but for the period to date. The foreman should be requested to explain the differences. If the standards are correct the responsibility should be forcefully put to the foreman to keep these overhead items as near the standard as possible. If such statements are sent regularly to the foremen of the various departments, they will soon look forward to them with much interest and anticipation. The result will inevitably lead to lower overhead costs.

Cost of Sales. The costs of production will find expression in the general ledger, Cost of Sales Ac-

count, which should be properly split in an analysis ledger. The monthly entry affecting cost of sales may be as follows:

```
Cost of Sales . . . . . . . . . . . . . . . . . . .$00.00
    Raw Materials Inventory . . . . . . . . . . . . . . . .$00.00
       (If any sold)
    Finished Parts Inventory. . . . . . . . . . . . . . . . 00.00
    Subassembly Inventory . . . . . . . . . . . . . . . . . 00.00
    Finished Product. . . . . . . . . . . . . . . . . . . . 00.00
```

In the procedure explained we will assume that sales consisted of finished goods only. A journal voucher would be as in Journal Entry 26.

(Journal Entry 26)

```
511. Cost of Sales—Finished Product . . .$4,692.40
1155. Finished Product . . . . . . . . . . . . . . . .$4,692.40

      To record the cost of finished goods sold or
      shipped during the month of January, 19
```

Analysis of Cost of Sales. The difference between the Cost of Sales Account and the Sales Account on the general ledger will express the gross or manufacturing profit realized on all sales. If the items are few, both the Cost of Sales and Sales accounts should be classified in the analysis ledger or in the general ledger, as follows:

1. Cost of Sales—General Ledger Account
    - (a) Cost of Raw Material Sales
      (Further subdivided into classes if necessary)
    - (b) Cost of Finished Parts Sales
      (Further subdivided into the kind of parts if necessary)
    - (c) Cost of Subassembly Sales
      (By classes if necessary)
    - (d) Cost of Finished Product Sales
      1d1. Product A
      1d2. Product B, etc.

SALES JOURNAL Month of__________ 19____

				—DEBITS—		—CREDITS—							
						COMMODITIES							
						Raw Materials		Finished Parts		Subassembly		Finished Prod.	
Date	Name	Invoice No.	Date Paid	Accounts Receivable	Cash Sales	Quant.	Value	Quant.	Value	Quant.	Value	Quant.	Value

FIGURE 47.

If the Cost of Sales Account is analyzed in this way, it will be necessary to present the sales in the same way. How far the analysis of the cost of sales should be carried depends largely upon the management. Any analysis to be of service to the management should show the various sales on which costs are to be compiled in both the general ledger and the analysis ledger. A sales journal which shows not only values but also the quantities of sales will best answer this purpose. The quantities will serve as the multiple for crediting the proper inventory account at the unit cost for the quantities sold, or at least provide a quantity check on the requisitions made by the sales department on the stores department in control of the products sold.

Just as materials or parts are put into production thru requisitions on the stores department, so all sales or shipments must be requisitioned by the sales department or shipping department. Such requisitions should "tie up" with the quantities indicated on the sales invoices, which may be established thru the use of a sales journal, indicating not only the values but the quantities of the various commodities sold. The form shown in Figure 47 has been found adequate for this purpose.

Credit columns for the general classes of sales only are shown in this form. If further analysis is desired, each class column may be divided as required, or monthly analysis may be made at the foot of each class column, at the end of each month. Each commodity column is subdivided to show quantities and values.

At the end of each month it will be a simple task to arrive at the multiple to be used for each class in order to arrive at the necessary figure to credit to the

various inventories, at cost, and to charge against cost of sales. By this method a check up is possible between the sales journal and the stores department, the latter crediting inventory accounts from sales requisitions. The quantities and values used in both the stores department and the accounting department should agree.

This sales journal form analyzes on the one form both charge and cash sales. The cash sales column is a debit column, and the total will be charged monthly to the Cash Sales Account in the general ledger. The credit to this account will balance it and will come from the cash receipts record containing a credit column for cash sales. It is not necessary to discuss here the use of the invoice number and "date paid" columns, except to suggest that their proper use, combined with a paid and unpaid sales invoice files, may, if customers pay their bills promptly, eliminate the need for an accounts receivable ledger.

General Ledger Accounts Controlling Costs. In the beginning of this chapter the general ledger accounts necessary to fully control cost accounts were stated.

The inventory balances at January 1, 19—, may be as follows:

1151	Raw Materials	$ 782.50
1152	Manufacturing Supplies	580.00
1153	Finished Parts	1,285.60
1154	Subassemblies	875.90
1155	Finished Product	1,885.20

With these balances to start, all of the foregoing transactions are posted from the cost journal and voucher register to the various cost control accounts shown on pages 187 to 191.

1151--RAW MATERIALS

Date	Items	Fol.	Debits	Credits	Fol.	Items	Date
19							19
Jan. 1	Balance.		$ 782.50	$3,988.50	J.V.2	Issued	Jan. 31
Jan. 31	Purchases.	V. R.	6,788.10	3,680.40		Balance.	Jan. 31
Jan. 31	Stores Burden. . . .	J.V.1	98.30				
			$7,668.90	$7,668.90			
Jan. 31	Balance.		$3,680.40				

1152--MANUFACTURING SUPPLIES

Date	Items	Fol.	Debits	Credits	Fol.	Items	Date
19							19
Jan. 1	Balance.		$ 580.00	$1,105.00	J.V.2	Supplies Issued. . . .	Jan. 31
Jan. 31	Purchases.	V. R.	4,205.60	3,734.15		Balance.	Jan. 31
Jan. 31	Stores Burden. . . .	J.V.1	41.55				
Jan. 31	Scrap.	J.V.14	12.00				
			$4,839.15	$4,839.15			
Jan. 31	Balance.		$3,734.15				

1153--FINISHED PARTS

Date	Items	Fol.	Debits	Credits	Fol.	Items	Date
19							19
Jan. 1	Balance.		$1,285.60	$2,482.75	J.V.18	Parts Issued	Jan. 31
Jan. 31	Cost of Parts Mfgd.	J.V.16	3,322.76			For Subassembly. . . .	Jan. 31
Jan. 31	Stores Burden. . . .	J.V.17	16.61	174.10	J.V.22	Parts Issued for Final	
						Assembly	Jan. 31
				1,968.12		Balance.	Jan. 31
			$4,624.97	$4,624.97			
Jan. 31	Balance.		$1,968.12				

1154--SUBASSEMBLIES

Date	Items	Fol.	Debits	Credits	Fol.	Items	Date
19							19
Jan. 1	Balance.		$ 875.90	$4,008.00	J.V.22	Issued	Jan. 31
Jan. 31	Manufacturing Cost of			1,887.71		Balance.	Jan. 31
	Subassemblies. . .	J.V.20	4,989.88				
Jan. 31	Stores Burden. . . .	J.V.21	29.93				
			$5,895.71	$5,895.71			
Jan. 31	Balance.		$1,887.71				

1155--FINISHED PRODUCT

Date	Items	Fol.	Debits	Credits	Fol.	Items	Date
19							19
Jan. 1	Balance.		$1,885.20	$4,692.40	J.V.26	Cost of Sales.	Jan. 31
Jan. 31	Cost of Manufacturing	J.V.24	5,680.25	2,873.05		Balance.	Jan. 31
			$7,565.45	$7,565.45			
Jan. 31	Balance.		$2,873.05				

1156--PRODUCTION ORDERS IN PROCESS

Date	Items	Fol.	Debits	Credits	Fol.	Items	Date
19							19
Jan. 31	Raw Material	J.V.2	$3,988.50	$ 112.00	J.V.14	Defective Work	Jan. 31
Jan. 31	Direct Labor	V. R.	5,986.40	3,322.76	J.V.16	Cost of Parts	
Jan. 31	Direct Expense	V. R.	50.00			Finished	Jan. 31
Jan. 31	Dept. 1 Overhead	J.V.15	3,251.11	4,989.88	J.V.20	Cost of Subassemblies	
Jan. 31	Mfgd. Parts Used	J.V.18	2,482.75			Finished	Jan. 31
Jan. 31	Dept. 2 Overhead	J.V.19	2,410.07	5,680.25	J.V.24	Cost of Product	
Jan. 31	Parts and Subassemblies					Finished	Jan. 31
	Used in Final Assembly	J.V.22	4,182.10	9,694.14		Balance.	Jan. 31
Jan. 31	Dept. 3 Overhead	J.V.23	1,448.10				
			$23,799.03	$23,799.03			
Jan. 31	Balance.		$ 9,694.14				

151--FACTORY EXPENSE

Date	Items	Fol.	Debits	Credits	Fol.	Items	Date
19							19
Jan. 31		V. R.	$2,252.60	$7,299.12	J.V.26	Redistribution to Reserves for Factory Overhead	Jan. 31
Jan. 31		C. J.	5,046.52				
			$7,299.12	$7,299.12			

2361--RESERVE FOR FACTORY OVERHEAD--DEPT. 1

Date	Items	Fol.	Debits	Credits	Fol.	Items	Date
19							19
Jan. 31	Factory Expense. . .	J.V.25	$3,341.50	$3,251.11	J.V.15	Overhead Absorbed. . .	Jan. 31
				90.39		Balance.	Jan. 31
			$3,341.50	$3,341.50			
Jan. 31	Balance.		$ 90.39				

2362--RESERVE FOR FACTORY OVERHEAD--DEPT. 2

Date	Items	Fol.	Debits	Credits	Fol.	Items	Date
19							19
Jan. 31	Factory Expense. . . .	J.V.25	$2,481.73	$2,410.07	J.V.19	Overhead Absorbed. . .	Jan. 31
				71.66		Balance.	Jan. 31
			$2,481.73	$2,481.73			
Jan. 31	Balance.		$ 71.66				

2363--RESERVE FOR FACTORY OVERHEAD--DEPT. 3

Date	Items	Fol.	Debits	Credits	Fol.	Items	Date
19							19
Jan. 31	Factory Expense. . .	J.V.25	$1,475.89	$1,448.10	J.V.23	Overhead Absorbed. . .	Jan. 31
				27.79		Balance.	Jan. 31
			$1,475.89	$1,475.89			
Jan. 31	Balance.		$ 27.79				

511--COST OF SALES OF FINISHED PRODUCT

Date	Items	Fol.	Debits	Credits	Fol.	Items	Date
19							
Jan. 31	Cost of Goods Sold	J.V.25	$4,692.40				

The balance at January 31 in the Raw Materials Account represents the book inventory value of raw materials in the storeroom. The aggregate balances of all material accounts in the stores ledger should reconcile with this amount. Therefore, the Raw Materials Account controls the raw materials stores ledger.

In a similar manner the Manufacturing Supplies Account controls the stores ledger of all supplies.

The Finished Parts Account has a balance of $1,968.12, which must also control the aggregate balances of the accounts in the manufactured parts stores ledger. In the same manner the controlling accounts for subassemblies and finished product may control the inventories of all subassemblies and finished commodities.

The balance in the Production Orders in Process Account at January 31 is reconciled with the master cost sheets of production orders in process for parts, subassemblies, and final assembly. From the master cost sheets an analysis of the balance of $9,694.14 may be made to show the value of

(a) Materials in process
(b) Labor in process
(c) Overhead in process

The Factory Expense Account is charged with the actual expenditures for the current month and is credited with the application of these expenditures to operating departments.

The departmental reserves for factory overhead are charged with the actual factory expenses and are credited with the amounts absorbed thru the use of predetermined rates applied to the actual production time.

The balances in these accounts consist of two factors:

1. Increase or decrease of actual over standard expense.
2. Unearned burden due to subnormal production, or overearned burden due to supernormal production.

A complete history of these balances may be obtained from a statement such as Figure 46.

Reserve for Light, Heat, and Power is debited with the actual expenditures of the power house for the current month and is credited with one-twelfth of the annual estimate as set up in the budget. Likewise, all repair items are charged to the respective reserves for repairs, the credits to these accounts being one-twelfth of the annual estimate.

This plan results in equalizing the monthly charges to Factory Expense. If repairs were charged to Factory Expense as they occurred, there might be a very small charge in one month's expense and an abnormally large charge for another month. Since repairs expense does not occur as a regular monthly charge but is irregular and sporadic, the average expense for the year can best be handled as a regular monthly charge thru the creation of reserve accounts. A complete analysis of the charges to reserves for light, heat, and power, repair, and stores burden accounts may be obtained from the vouchers, and statements may be prepared showing the actual expense in comparison with the standard expense for the current month, and the cumulative period to date.

Figure 48 at the close of this chapter shows the charges to Production Orders in Process Account and to Factory Expense Account, and also indicates how the costs are transferred to Finished Goods Inventory as the product is completed.

The balance at January 31 in the Raw Materials Account represents the book inventory value of raw materials in the storeroom. The aggregate balances of all material accounts in the stores ledger should reconcile with this amount. Therefore, the Raw Materials Account controls the raw materials stores ledger.

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Figure 48 at the close of this chapter shows the charges to Production Orders in Process Account and to Factory Expense Account, and also indicates how the costs are transferred to Finished Goods Inventory as the product is completed.

FIGURE 48

Summary of Procedure to Reflect Factory Costs in General Ledger Controlling Accounts

Chapter XII

OTHER METHODS OF FACTORY OVERHEAD DISTRIBUTION

Altho the machine-hour rate has been used as a basis for the distribution of factory overhead, there are, nevertheless, other methods of distributing overhead, some of which, in special cases, may be even more satisfactory than the machine-hour rate.

Before entering upon a discussion of these methods, it should be borne in mind that in deciding upon any method of charging overhead, the big question is not, "Which system is the best?" but "Which method will best meet our requirements?" because there is no one "best" method that includes all plants, as plants are not all alike. Some are large and manufacture watches; others are small and make automobiles. Some have a full-fledged cost department to conduct their cost accounting, while others are just installing one. These and scores of other factors must be taken into consideration before the "best" method can be decided upon.

The Three Methods in General Use. In the last analysis it is the cost accountant who must decide, but he must, of course, have a working knowledge of the fundamental principles underlying each method, otherwise he cannot square his requirements against them and select the one best adapted to his business. The

following three methods are representative of those in common use, in addition to the machine-hour rate:

1. Prime Cost
2. Direct Labor Cost
3. Direct Labor Hours

Prime-Cost Method. Prime cost is the sum of direct-labor cost and material cost. It includes all direct expenditures on the product manufactured. All other manufacturing expenses, such as indirect labor, manufacturing supplies, depreciation, repairs, insurance, taxes, light, heat, power, etc., form a single group of indirect expenses or factory overhead which must be prorated to departments and products by some fair method. In using the prime-cost method for distributing the factory overhead, there are only the two elements of production cost to be considered; namely, the prime cost and the factory overhead. The method is to add to the prime cost of product (direct labor and direct material) the percentage which the overhead bears to the prime cost.

The method may be based upon the entire operations of the factory, upon departmental operations, or upon separate products. Where the application is based upon the entire operations, the problem is the simplest. For instance, if the entire prime cost during a period of operations is $100,000.00 and the entire factory overhead amounts to $40,000.00, then the addition of 40 per cent to the prime cost of any article manufactured represents that article's participation in the factory overhead. Where a departmental distribution is desired, the total prime costs and overhead must first be allocated properly to the various departments. The

products of each department will then be burdened with the particular departmental rate applicable. For instance, the $100,000.00 prime cost and the $40,000.00 overhead could be allocated to the three departments, as follows:

Dept.	Prime Cost	Overhead	Per Cent of Overhead to Prime Cost
1	$50,000.00	$10,000.00	20%
2	30,000.00	25,000.00	83⅓%
3	20,000.00	5,000.00	25%
Total	$100,000.00	$40,000.00	40%

In this case the prime cost in Department 1 will be burdened with 20 per cent overhead; Department 2 with 83 1/3 per cent; and Department 3 with 25 per cent. This shows at a glance the unfairness of applying a general rate, based upon total production, to the products manufactured in each of the various departments. If a flat rate of 40 per cent were added to products coming thru Department 2, those products would be underburdened, whereas the application of 40 per cent would overburden the products made in Departments 1 and 3.

If the application of overhead on prime cost were made on products, the product would have to be followed thru the various departments. Assume Product A going thru all three departments, with the prime costs of the product distributed as follows:

Dept.		Dept. Rate	Overhead
1	$200.00	20%	$40.00
2	50.00	83⅓%	41.67
3	150.00	25%	37.50
Total	$400.00		$119.17

The entire overhead added to the product is $119.17. If the general rate of 40 per cent had been added, the overhead would have been $160.00.

The prime-cost method assumes that the material used produces overhead. This is true only in industries where direct labor is almost negligible. In almost every factory direct labor is the active force of production, and machines and equipment exist as tools to assist direct labor. Power is necessary to make the machines usable by labor; light and heat make it possible for labor to function properly; and depreciation is the wear and tear of the machines operated by labor. It is the application of labor to product thru machinery, buildings, power, etc., that creates factory overhead in all but a very few industries.

Where production is automatic and direct labor nominal, the prime-cost method may in some cases be justified, but only when the relative values of materials used register with the relative quantities of materials. Under such conditions, it might be argued that whatever labor is employed should be regarded as an overhead expense, and that the material cost alone should serve as the basis for overhead distribution, provided, of course, that values of materials harmonize with quantities. Ordinarily, the quantities and not the values of materials should be used wherever materials are made the basis of overhead distribution, otherwise small quantities of materials carrying high values will be overburdened.

It is apparent then that the prime-cost method or even the material-cost method has a very limited application, and that in cases where direct labor is a factor

in production the prime-cost method is not applicable at all, even tho material values may form the larger part of the prime cost. Material values create no overhead during the time the materials are going thru a process of production, while the quantities of materials create overhead only in connection with their storage, or possibly where they alone go thru automatic processes of production, in which case material quantities and not values must form the basis for the overhead allocation.

The impracticability of prorating overhead on the prime-cost method shows up forcefully in industries where direct labor works on both cheap and expensive materials. For instance, during two hours per day a laborer may be working on an expensive brass casting, and for the remainder of the day on a very cheap iron casting. The costs for the day might be itemized as follows:

Labor			Material	Prime Cost	Product
Time	Rate	Cost			
2	$0.75	$1.50	$100.00	$101.50	Brass Castings
7	.75	5.25	20.00	25.25	Iron Castings
9	$1.50	$6.75	$120.00	$126.75	

If the overhead rate for this work were 40 per cent of the prime cost, the brass castings would be burdened with $40.60 and the iron castings with only $10.10, altho more than three times as much labor was expended on the iron casting than on the brass. Assuming that the same tools and machines were used on both products, what could the value of the materials have to do with the overhead expense? Without question, the worker used his time and the manufacturing

facilities for two hours on one product and seven hours on the other. The building, light, heat, and power were also used in these proportions; depreciation, insurance, taxes, etc., likewise had to be absorbed in the same proportion. It would seem that if a machine rate were not employed, the direct labor hours or direct labor wages would be much better bases for overhead distribution. The wage rate being the same on both products, the result obtained by using either labor hours or labor wages would be the same. The total overhead applied by the prime-cost method to both products amounted to $50.70, and it is assumed that this is the correct amount applicable. If this is now applied on the basis of direct labor hours, a wide variation is apparent in results obtained when compared with the prime-cost method. The comparison is as follows:

	Prime Cost	Overhead on Prime Cost	Overhead on Labor Hours
Brass Castings	$101.50	$40.60	2/9--$11.27
Iron Castings	25.25	10.10	7/9-- 39.43
Total. . . .	$126.75	$50.70	9/9--$50.70

By using the direct-labor hours, the figures obtained by the prime-cost method have been almost reversed, and the impracticability of the prime-cost method in the case illustrated is disclosed. Of course, neither the prime cost, the direct-labor hours, nor the direct-labor cost methods ordinarily take into consideration the variations in values of the machines used in production, so that from this standpoint they are all more or less inaccurate. Under all these methods, the overhead rate is generally for a department as a whole, and the

variations in machine values are not considered. Where these value variations result in a close departmentalization on the basis of machine types, fair results may be gained by using the direct-labor hours method, or even the direct-labor wages method, if the wage rate for all labor in such a department is about the same.

Direct-Labor Cost Method. The direct-labor cost method of distributing factory overhead is applied, either on the basis of the relationship of total overhead to total direct labor wages, or on this relationship in each department. There will naturally be a difference in the results obtained by each application. If the total overhead in a plant is $50,000.00 and the total direct labor, $50,000.00, then 100 per cent would be added to the direct-labor wage charged to each product. A product showing a direct-labor cost of $100.00 and a direct material cost of $200.00, would present a total production cost of $400.00. If made in a department where the overhead percentage to direct labor wages was only 75 per cent, it would be overburdened by $25.00, as the total cost would be only $375.00.

The direct-labor-cost method does not take into consideration variations in the labor rate, nor in the values of the machinery and equipment thru which the product passes. A $0.75 per hour man may be working at a $5,000.00 machine having a life of 10 years, and a $1.00 per hour man may be employed at a lathe costing $500.00 with a 20-year life, yet more overhead would be applied on the production of the high-priced labor than upon the low-priced labor. This method would be fair only where the rate of pay for labor is prac-

tically uniform and the machines and equipment of about the same character and value.

Where the method is modified to produce this uniformity thru departmentalization, it is far more accurate and a big improvement over the prime-cost method. Ordinarily, a departmentalization rarely produces the uniformity in wages, rates, and machine-investment conditions suggested.

Direct-Labor Hours Method. It has been the author's experience that of the three methods discussed, the direct-labor hours method has the most in its favor so far as results are concerned. It removes the handicap of wage-rate variations, even tho it does not allow for the inequalities in the variations in machine values. If the method is applied by the use of a rate per hour determined by dividing the total overhead for a period by the total direct-labor hours for that period, then the method has little value. But if a departmentalization is effected, and arranged so as to place all machines of the same type in one department, and then a rate per hour of direct labor for each department is used, the method will yield fairly accurate results. For example, if all drill presses, lathes, punch presses, reamers, hobbing machines, etc., could be segregated in separate places and considered as separate departments, a separate overhead rate per hour of direct labor for each department might prove to be very fair and accurate.

This would be equivalent to establishing production centers and separate overhead figures for each of these production centers. The overhead cost of each center would be divided by the number of direct-labor hours

expended in the center during a certain period selected as presenting a normal condition. Since, in most cases, the direct labor hours would coincide with the machine hours, there would then be a close approximation to the machine-hour rate method. The departmentalization by machines, as suggested, could be effected only in large plants where production demanded it. Even then the rate would be based upon direct-labor hours actually expended during some past period and would not bring out the cost of unused machine capacity.

In the average factory, machines cannot always be logically segregated, nor are the machines of the same type necessarily of the same values. In many plants making varied products, machines of the same general types will be scattered in order to speed up the progress of a great many different orders thru different sections of the shop. In this case, machine departmentalization for each type of machine is quite impossible, and the direct-labor hour method of prorating overhead would not produce the desired results. Where, however, continuous production of one or a very few products exists, thus permitting machine segregation, the direct-labor hour method would, in many cases, be practical.

It is apparent from our discussion that each of the three methods has its shortcomings and that none has a general application, except where unusual conditions exist. It is for the cost accountant to decide whether or not these conditions prevail in his plant.

In an industry where the material is of major importance and labor merely incidental, the overhead may be applied in accordance with the quantities of

materials produced or passing thru the plant, but rarely on the basis of relative values of materials. It is advisable to use the value basis only where the relative values and quantities are the same. The direct-labor methods (both cost and hours) have a limited application in industries where the labor rates do not fluctuate materially within narrow departments carrying equipment and machines of the same type and values. Outside of these exceptional cases, actual experience has demonstrated quite conclusively that the machine-hour rate method has the widest application and yields the most accurate results.

Chapter XIII

INTEREST ON PLANT INVESTMENT

So much of the world's business is done on credit and borrowed funds that some people have concluded, and we believe, erroneously, that a man's own capital is merely loaned to him, and that he is, therefore, not a proprietor but a creditor of himself. Such a conception would imply that a man owes to himself that which he already owns. This is a duality which, in the author's opinion, would be extremely difficult to establish either legally or from an accounting standpoint.

Cost accountants, quite generally, are of the opinion that the underlying fundamentals of proprietorship would present an insurmountable obstacle to the conception of a proprietor as a creditor of himself. The time has come, in our opinion, for a thoro clarification of this much mooted question of interest on plant investment as a cost of production. A man cannot be considered a creditor of himself merely because he has enough money of his own and does not need to borrow any.

Dual Personality of Proprietorship. If the proprietor is also his own creditor to the extent of his proprietorship, at what time is this dual personality created? Does he become a creditor of himself at the moment when he decides to use his capital for manufacturing purposes or did the change take place while the capital was in other forms such as municipal bonds or rental property? When his capital was "tied up" in

bonds was he then a creditor of himself? The capital was his. If he loaned it to himself he had a right to expect something. When he was a bondholder was the ownership of the bonds vested with the proprietor or the creditor? If we admit the duality, the answer is, the creditor, because the form of investment should not influence the duality. If a man's legal and actual possessions are not his own, but are merely loaned to him, then he can never reach a point when he becomes a proprietor. Personally, the author believes that the creditor's claims should be liquidated at once so that the proprietor may come into his own.

But does not a proprietor receive interest on the money he invests in bonds or in property? Without a doubt, and the interest and rent he receives he calls income. If he decides to become a manufacturer and changes his investment from bonds into factory buildings, land, machinery, and equipment, he will also expect income. He becomes a manufacturer to obtain not only as much income as formerly, but he hopes to obtain more. He is no longer satisfied with a 6 per cent return, because if he were he would not become a manufacturer. As a manufacturer he assumes greater responsibilities and takes larger risks; he becomes the actual manager of his capital and he anticipates larger rewards.

Instead of interest he is seeking profits. Whether he will make more or less profit than he did interest will depend upon his managerial ability, because he is now managing his capital himself. The courts have never considered that a proprietor is a creditor of himself to the extent of his entire estate, because in no liquidation proceeding has the proprietor ever been

regarded as a creditor. His entire investment is at the mercy of outside creditors; even his claim for interest would have no weight, and as a real creditor against himself he would have no standing in court.

The Nature of Interest. Interest is income. In some cases it may be the entire income, in other cases less or more than the entire income. In business we are interested primarily in the entire income no matter under what label it appears.

It may be all well and good for those who wish to do so to subdivide the entire net income actually earned into amounts representing a fair interest return on investment, a return for economic rent, and a return of pure profit for risk and management. It is not logical, however, to advance the argument that any portion of that income is a cost of production to be injected into the already intricate maze of factory overhead represented by actual expenditures.

When interest is charged as a cost of production, it would seem that the hope is to insure a return of at least the interest. What has the cost of production to do with insuring a return? Returns and profits are insured thru price making, and while price making is guided by cost figures, the prices may or may not result in sales. What then happens to the interest which we wished to insure to ourselves? Or, if the product will sell at a proper price, why do any price fixing in the cost department? Price fixing is an administrative and selling department function. When actual costs of production are known, price-fixing procedure may include an elaborate scheduling of economic rent and interest on the investment.

But if accountants who take the economic viewpoint insist upon including interest on the capital investment in costs, it might be recommended to them that they go a little further.

What a Manufacturer Demands. The manufacturer does not want merely interest, else he would not be a manufacturer. He wants a profit considerably larger than an interest return. Why not insure to him all that he expects his plant to yield? Why not be logical and charge a rate on the investment sufficient to return the entire expected profit? That would be much more satisfactory and the proprietor could point with greater pride to the larger amount of income his costs were yielding him. And he could do that without reference to sales, as he would always be providing for it in costing his goods.

It would be possible to show a profit in a manufacturing plant before any goods were sold, and yet we are quite well satisfied that no net income or profit can be realized in any business without sales. But where interest on the investment is charged as a cost, and interest earned on the investment is credited, we actually have the phenomenon of a profit before the profits have been realized thru sales. Such will be the condition during any period of manufacturing for stock or in any seasonal business. And, is it not a fact that even during a period of selling the process of manufacturing for stock is also going on, and that this tendency to make profits before profits can be earned is always in effect? In other words, this leads us naturally to the conclusion that whatever profit is made, even tho it be set up in advance of sales, can only

be made (if made at all) when the sales are effected, and that no profit can be made thru a cost. If we must await the sales before it is in any way possible to know a profit, why inject fiction into accounting thru a procedure of costing a profit which may or may not be realized, especially since the costing of the expected profit has very little, if anything, to do with the profit actually realized thru the sale? Again, we must emphasize the fact that the selling price is largely forced by competition, or what the "traffic will bear," and not by any plan of costing. In price making the important consideration is not the injection of a portion of anticipated return into costs, but rather the establishing of production standards and plans leading to reductions in actual cost outlays, thus insuring a production cost low enough for the actual sale to yield a profit.

To a very large degree the exponents of the "interest as a cost" doctrine refute their own theory when consideration is given to inventories at the close of any accounting period. They are, as a rule, ready to admit that the inventories must be reduced by the interest increment included, because certainly that interest increment could not have been earned any more than any other portion of the entire expected income from inventories. Otherwise, they might just as well take the inventories at selling price and thus realize at once the entire expected return, forgetting, of course, all selling or administrative expenses necessary to market the goods.

If interest on the investment is a true cost of production, then it should legitimately be part of inventory value, and the larger profit which might result should

appear in the profit and loss statement. Naturally, that larger profit should be taxed under federal revenue laws. But if the interest increment in inventories cannot be considered, then interest on the investment cannot be a true cost; because in inventories one is thoroly justified in including all costs. In fact, it would be absolutely wrong to exclude any real costs. And by excluding interest from the inventories and resorting to the good old rule of "cost or market, whichever is lower," the entire interest principle is denied, and, instead, it is asserted in the very strongest terms that income can only be realized thru sales and that any other profit-making element is a fiction. We further assert that the interest charge made during the year is merely a fancy, because whatever profit (including the interest credit, if you please) has been made was thru completed sales, and no profit has been made because of the interest charge, since the entire residue thereof (in the inventories) is eliminated. In eliminating the interest from the inventories we put ourselves on record that the charge should never have been made, since inventories are always in the making.

The author has no quarrel with the man who wishes to employ interest calculations in measuring the relative productivity of various types of equipment, but that comparison does not make the interest calculation a cost of production; it merely indicates the wisdom or folly of an investment. In fact, it is questionable whether most executives think of interest when a new piece of equipment is purchased. The thought is rather one in which consideration is given to greater productivity. If, for example, a present automatic tool valued at $1,000.00 produces 100 units per hour, and

another tool may be had to replace it for $2,000.00, but with a capacity of 250 units per hour, everything else being equal, no executive will hesitate in securing the higher priced tool, and no consideration need be given to interest. Even if other elements should be considered, the interest element need not enter into calculation. Suppose everything else were not equal and it were found that the more expensive tool had a life of only five years against fifteen of the lower priced one, that three times as much power were needed, and that the estimated repairs were considerable, the decision would be in favor of retaining the present low-priced tool and adding another one or two of the same kind. No interest calculation would be necessary. It seems to the author that if interest were considered, the decision would always be in favor of the highest priced tool, irrespective of the other considerations, because the more valuable the investment the higher the interest yield to be returned thru costs!

What Interest Rate Should Be Charged. If we were to admit for the moment that interest on investment should be charged as a cost, may we be enlightened as to the rate? What interest is to be charged—the legal rate prevailing in any given state, or as much as the courts will permit—the maximum rate? In some Western states where the legal rate may be 6 per cent (that is, the rate where instruments read "with interest" only), contract rates of as high as 10 per cent are permitted by law. What rate shall be charged into costs? A manufacturer in a Western state may consequently charge 10 per cent into his costs, some Eastern manufacturer in the same business may charge only 5 per cent, and yet they may both be in competition for

trade in the Central States! We were always under the impression that cost accounting was to make competition intelligent. With such a variation in interest rates between manufacturers in different districts, how can there be intelligent competition? Or perhaps the interest doctrinaires have in mind that intangible economic interest which fluctuates, we know not when or how, which is dependent upon the whole nation's intrinsic worth and prosperity, and which may be 2 per cent or 3 per cent or even a minus quantity.

How the Courts Have Ruled. That the fallacy of including interest on the investment is widespread is clearly evidenced by our courts which have even allowed it in case of wrongdoing. We have in mind patent infringement cases where several U. S. District Courts have actually allowed the infringer an interest return on the funds invested by him in committing his misdeeds. An actual premium is thereby placed on wrongdoing. In fact, such court action actually invites investment for infringement of established patents. The infringer cannot suffer because he is assured a return on the capital he employs to damage the patentee. It makes the investment in wrongdoing as safe as a government bond, and offers a larger yield in view of the fact that the courts have generally allowed an interest rate of 5 per cent or 6 per cent. It means that any man with capital may with impunity invest his funds in the manufacture of articles or devices covered by patents owned by others and be sure of a comfortable return on his investment.

The Author's Contention. The author contends that interest on an investment is a return, an income,

and that the income or profit made by an infringer is the property of the damaged party, and that the infringer by using property rights (patents) not his own has made himself a trustee for the patent owner and is obliged to turn over to the patent owner the entire benefits derived from the administration of the beneficiary's property; the trusteeship being illegal, thru the fact of actual misappropriation of another's legal rights, should not be viewed as entitling the trustee to any rewards or profits (interest) for his malfeasance. On the contrary it would appear that not only the entire profits (including interest) should be awarded to the damaged party (the patent owner) but that exemplary damages in addition should be imposed upon the wrongdoer for the very act of misappropriating to himself the patent rights of another. The courts have argued that the infringer should receive interest on the funds invested in infringing the patent because of the fact that the infringer used his capital to produce profits for the damaged party. But suppose the profits produced are not as large as an interest allowance on the capital invested for infringement? Perhaps then the patentee might owe the infringer money, because the latter did not make a success of the infringement!

The contention raised by some that the patentee had the same opportunities to produce the patented article is rather inane, because the mere ownership of a patent does not furnish the patentee with capital, nor does this contention justify the wrongdoing of a wealthy investor in infringement. In fact, it may be to the decided advantage of an infringer to "tie up" his capital in an infringement, for by so doing he may be

able to gain control of the market, entirely "freezing out" the patentee, thus creating a condition at the expiration of the patent which will leave no room for the patentee's competition. Such an investment of capital must be particularly desirable if an infringer is at the same time insured an interest return on his investment. It is true that courts have satisfied patentees thru awards of damages, which in very flagrant cases have been fully punitive, but it must be borne in mind that in very few cases have the awarded damages returned the entire profits which the patentee might have himself made, or the large expenditures he has made in fighting the wrongdoer.

Even tho we should regard the capital owned and employed by a manufacturer as loaned to himself or to his business, there is no justification in considering an interest charge thereon as a cost of production. It would, just as in the case of borrowed money, be a division of total net profits from operations, with the exception that the interest on the capital invested would not be disbursed, but would remain in the business as a part of the total net profit. Interest on borrowed money is an expense incurred because of lack of working capital, and it is paid to an outsider out of the profits made in business. In other words, an outsider has helped the proprietor provide working capital, and the proprietor must consequently share some of his net income with the lender. The fact that money has been borrowed has in no way increased the costs of production. The materials going into the product have cost no more, the wages paid were not increased, nor has the plant depreciated any more rapidly because of the loan. The county and state did not increase the pro-

prietor's taxes because he became a borrower, and in fact none of his factory indirect expenses (overhead) were increased because he had to pay interest on a loan. His profits from operations were not affected in the least, and the fact that he could not retain them in their entirety for his own use, but had to share them with the lender, was only an indication of his limited capital and in no way concerned his costs of production.

If a manufacturer has sufficient capital so that he need not share his profits with others, his costs in that case also cannot be affected even tho he lend his capital to himself. His material, his labor, and the factory overhead costs are not increased. Costs cannot be more than costs, and interest on his investment represents not an expenditure, but merely an arbitrary division of the entire profit which is entirely payable to himself. Because a man is his own creditor offers no reason for treating the interest payable to him in any other manner than interest payable to an outside creditor. Costs cannot be affected, and the profits are all the proprietor's; no harm can come from the innocent delusion of paying himself his profits as part interest and as part pure profit for his managerial propensities. But, suffice it to say always, a profit, no matter what its nature or its theoretical component parts, can never be a cost, not even under the monumental fiction of making a proprietor a creditor of himself.

Summary of Interest as a Cost Factor. At the second international conference of the National Association of Cost Accountants, interest as an element of cost was fully discussed. The following arguments were brought out for the inclusion of interest in cost:

1. From the economic standpoint interest is a charge for the use of capital, just as the use of land, means a cost for rent and the use of labor a cost for wages.
2. Business men deem interest inclusion practically necessary—
   (a) to measure relative economy of methods and machines.
   (b) to measure the time element in cost.
   (c) to compare inventory policies.
   (d) to compare complete and incomplete plants.
   (e) to compare owned and rented plants.
3. Interest as an element of cost aids in standardizing the basis of cost and in establishing a fair selling price.
4. The cost of materials stored for seasoning must include interest.

The following arguments against including interest in cost were advanced:

1. Economic cost cannot be reconciled with business cost.
2. The provision of capital is a financial proposition, and has nothing to do with the production of goods.
3. The interest rate to be used must be chosen arbitrarily and is difficult to select.
4. Interest entries do not represent values paid out or received.
5. The inclusion of interest leads to an inflation of inventories.
6. Bankers insist upon scaling down inventories to exclude interest.
7. Legal decisions are against interest inclusion.
8. The objects sought in including interest in costs can be secured equally well by entering interest calculations in supplementary records.
9. Interest on plant investment is in the same class as a dividend—a return upon capital—and is merely a division of the profits of a business enterprise.

Chapter XIV

PROCESS AND DEPARTMENTAL COSTS

In assembling industries, printing plants, clothing factories, wood and metal working plants—in fact in every factory where the products are made in distinct units or lots, a production or job order should be made out for each unit or lot and the factory cost of each order determined. As the goods on an order advance thru the manufacturing departments, the identity of the order will be preserved. This continuous identification of the product on a production order furnishes a means of charging the material, labor, and overhead costs to that order as the work on it proceeds.

On the other hand, in plants manufacturing paper, paint, varnish, chemical products, rubber, and in fact every industry where work is handled in bulk or where raw materials pass thru operations continuously until the product is finished, the costs are determined for each process. The sum of all the process costs of a product is then the total factory cost of that product. In such cases, it is obviously impossible to tell where one lot ends and another begins, because their identity is lost in the mass. Consequently, where the units of measurement are a designated part of a mass, such as pounds, tons, yards, cubic feet, bushels, or barrels, the nature of production requires that it be costed by processes.

The determination of costs under the order method involves the use of predetermined overhead rates. Under the process plan, the actual factory overhead

expenses as they are incurred are allocated to each process, and a process cost per unit of production is obtained.

A study of Figure 49 will show how the controlling accounts and the cost accounts are developed for both the order and the process method. These two methods are placed side by side so that points of divergence are plainly seen.

Feed-Mill Type of the Process Method. A common industry where the process plan of determining costs may be used to advantage is the feed mill. The mixing of various feeds in conformity with certain formulae is the essential operation; just what feeds to mix cannot always be predetermined, so that an order plan is impossible. All feeds are put thru the same mixing department and mixing machinery by the same labor. To follow each batch of ingredients thru to completion would be quite impossible.

The costs are determined on the basis of quantities produced. Altho the mixing process is the most important, there are others, such as grinding, sifting, sacking, and the like, which are applicable to certain ingredients only. Wherever a close division of processes is made, no product need be improperly burdened with more than its fair portion of costs. In most feed mills, the dairy feed absorbs practically all the grinding costs, because few, if any, of the ingredients of other feeds are ground. To show the application of the process-cost method, let us assume a feed mill making Products A, B, and C. There are a number of warehouses and elevators, the first for storing sacked grain and meal, the other for bulk grain. There are

Figure 49

Order vs. Process Methods

also storage facilities for molasses and for the various salts used in the mixtures. Adjacent to the mixing department are the bins operated on the gravity system. The question may now arise as to how the costs are allocated to the product.

Raw Material. In determining the cost of raw materials, we have besides the invoice cost, the in-freight, the unloading, and the storage cost. Grains, meals, alfalfa, and screenings are stored in different hoppers. The storage cost per bushel, per pound, or per ton of each commodity must be determined.

The time of storage is immaterial, as raw material is in and out constantly, but the total quantities of each commodity purchased each year must be determined so that a unit cost for storage may be fixed. This charge should generally be added to the product on a per ton basis, altho the detailed inventory accounts are generally reduced to pounds. As in the case of all storage charges, provision must be made for the operation of the warehouses and elevators, the depreciation and repairs, and for the amount of insurance and taxes applicable. The total expense for a year should then be distributed on a per-ton basis to the average annual purchases, according to the space they occupy in the elevator or warehouse in which they are stored. This charge, combined with the unloading, weighing, purchasing department and stores-keeping department expenses will indicate the figure to be added to every ton of commodities purchased. The amounts thus added to purchases will be credited to a reserve for inventory expense.

As commodities are taken from storage, the Inventory in Process Account will be charged, altho there

will rarely be a balance in this account at the end of the month, because ingredients put into process will be turned out as finished product in a comparatively short time. If any balance is shown, it may be accounted for by commodities in hopper bins, or by the quantities which may remain in the mixing tubes. A small balance may also appear in the Inventory in Process Account to represent the inevitable shrinkage which occurs in the processes of grinding and mixing.

Grinding Cost. The grinding-process cost will be determined by adding the cost of labor, manufacturing supplies, and factory overhead of the grinding department to the inventory values of the commodities going thru the process. Let us assume that the following commodities were ground during a month:

Commodity A	100 tons
Commodity B	250 tons
Commodity C	150 tons
Total	500 tons

These commodities were charged to the grinding department, as follows:

Commodity A	$ 4,000.00
Commodity B	4,500.00
Commodity C	9,500.00
	$18,000.00

Assume the expenses in the grinding department to be, labor $500.00, manufacturing supplies $50.00, and factory overhead $300.00 (representing estimated repairs, depreciation, taxes, and insurance on buildings, machinery, and equipment), or a total of $850.00. This expense would be distributed as follows:

	Fractional Quantity	Portion Expense	Value Material	Total
Commodity A . . .	1/5	$170.00	$ 4,000.00	$ 4,170.00
Commodity B . . .	1/2	425.00	4,500.00	4,925.00
Commodity C . . .	3/10	255.00	9,500.00	9,755.00
	10/10	$850.00	$18,000.00	$18,850.00

If the mixing process follows, this tabulation indicates that the mixing process is to be charged with $18,850.00, representing the total labor, material, and overhead charges created thru the grinding process. The charge will show the quantities as well as the values of the commodities so charged, viz:

Commodity A	100 tons	$ 4,170.00
Commodity B	250 tons	4,925.00
Commodity C	150 tons	9,755.00
Total	500 tons	$18,850.00

As far as the mixing department is concerned, these charges have the earmarks of material costs, and properly so, because the ingredients were ground in order that their mixture with other unground ingredients could be effected. After both the ground and unground ingredients have entered the mixing process, their values will be stated as follows:

	Quantity	Value
GROUND:		
Commodity A	100 tons	$ 4,170.00
Commodity B	250 tons	4,925.00
Commodity C	150 tons	9,755.00
UNGROUND:		
Commodity D	100 tons	4,500.00
Commodity E	50 tons	2,700.00
Commodity F	200 tons	6,000.00
Total	850 tons	$32,050.00

Mixing Cost. If the entire expense of operating the mixing department, including the labor of sacking the

mixed feed for shipment, all other labor, manufacturing supplies, and factory departmental overhead, amounts to $1,700.00 for the month or the run as the case may be, the final distribution of expense to the various commodities mixed would be as follows:

	Quantity Fraction	Portion Expense	Material Cost	Total
Commodity A	10/85	$ 200.00	$ 4,170.00	$ 4,370.00
Commodity B	25/85	500.00	4,925.00	5,425.00
Commodity C	15/85	300.00	9,755.00	10,055.00
Commodity D	10/85	200.00	4,500.00	4,700.00
Commodity E	5/85	100.00	2,700.00	2,800.00
Commodity F	20/85	400.00	6,000.00	6,400.00
Total	85/85	$1,700.00	$32,050.00	$33,750.00

These commodities are the raw materials. The mixing for different kinds of feed is by formulae. If these commodities are to be mixed into one kind of feed, the problem is simple enough, because the formula would be in accord with the proportioning shown. Since 850 tons put up in one-hundred pound sacks would give 17,000 sacks, then each sack would be worth one seventeen thousandth of $33,750.00 or $1.985 per sack, plus the charge for the sack itself. Ordinarily the mixtures should be by runs and the unit cost of the mixed feed is determined as indicated. But a condition may exist where separate runs are not practical and the commodities going into mixed feeds of varying formulae for a period of a month must be determined. In that event the packed feed must be reduced to formulae so that the exact ingredients of each class of feed may be properly costed. At any rate 850 tons must be accounted for after allowing for normal shrinkage, and a tabulation be prepared from the packing reports somewhat as follows:

	Formula 1 (Pounds)	Formula 2 (Pounds)	Formula 3 (Pounds)	Total (Pounds)
Commodity A	100,000		100,000	200,000
Commodity B	100,000	350,000	50,000	500,000
Commodity C	200,000	50,000	50,000	300,000
Commodity D	50,000	100,000	50,000	200,000
Commodity E	20,000	30,000	50,000	100,000
Commodity F	50,000	50,000	300,000	400,000
	520,000	580,000	600,000	1,700,000
100 lb. sacks ...	5,200	5,800	6,000	17,000

The unit costs of the various ingredients are as follows:

	Per Ton	Per Pound
A	$43.70	$.02185
B	21.70	.01085
C	67.03-1/3	.033514
D	47.00	.0235
E	56.00	.028
F	32.00	.016

The entire costs would have to be distributed over the various feeds represented by the preceding formula, as follows:

Commodity	Formula 1	Formula 2	Formula 3	Total
A	$ 2,185.00		$2,185.00	$4,370.00
B	1,085.00	$3,797.50	542.50	5,425.00
C	6,703.34	1,675.83	1,675.83	10,055.00
D	1,175.00	2,350.00	1,175.00	4,700.00
E	560.00	840.00	1,400.00	2,800.00
F	800.00	800.00	4,800.00	6,400.00
	$12,508.34	$9,463.33	$11,778.33	$33,750.00
Per Sack	$2.41	$1.63	$1.96	

This tabulation shows that by the process plan of costing the variations in the different ingredients as fixed by formulae are clearly indicated. Advantage is also gained by testing the quantities of materials called for by the formulae. If the formulae indicate one result and the inventory analysis another, then the formulae were not followed exactly. It is the formulae, and not an actual inspection of ingredients going into mixtures, that fix the credits to material inventory accounts.

Very often when an actual cut-off occurs in inventory accounts, on account of certain materials being entirely used up, the inventories will show shortages in some instances offset by overages in others, which of course also indicates that the mixtures were not entirely in conformity with the formulae. From a standpoint of operations this means that the mixing tubes were feeding either too much or too little of certain classes of materials. The result is almost automatic in that the operations may be readily corrected so that formulae results may obtain. In computing the costs for feed mixed, under Formula 1, the tubes should have fed materials for the mixture as follows:

Commodity A	10/52
Commodity B	10/52
Commodity C	20/52
Commodity D	5/52
Commodity E	2/52
Commodity F	5/52
Total	52/52

In computing production on formulae bases, Commodity A Inventory Account would be credited with 100,000 pounds, Commodity B with 100,000 pounds, etc. The same credits would be made for production measured by formulae for the other feeds packed. If some or all of the ingredients are completely used up after a run, it may happen that the credits to the inventory accounts will produce credit balances in certain material accounts and debit balances in others, altho nothing actually remains in either. Such a condition means that during a period of operations one mixture received more than its formula allowance of a certain ingredient and less of another. If the mixtures were actually as per formulae, no shortages or overages could exist in the inventory accounts.

Overages and shortages in the inventory accounts are adjusted at each "cut-off" thru an Inventory Adjustment Account, which should have practically no balance when an entire physical inventory is taken. At such a time all variations between book inventories and physical inventories are cleared thru the Inventory Adjustment Account. Any debit or credit balance remaining in the Inventory Adjustment Account should be cleared into the Cost of Sales Account. Generally such balances represent the degree of error in underestimating or overestimating the shrinkage in materials. In order to have effective inventory control in a feed mill, or in any plant where the process-cost method is used, accurate weights of incoming materials are very necessary.

The process plan of cost accounting has often been called the Mass Production Cost System, because the application of costs is to a mass of materials moving from department to department. These are to be identified finally thru a quantity measurement which will agree with the sum of all quantities originally put into production after making due allowances for shrinkages, wastes, and the like.

The process plan of costing is also applicable to the manufacture of brick, ice, and to a limited extent to the cutting department in furniture or woodworking plants. It cannot be used to advantage in foundry cost accounting unless under the very simplest conditions of foundry operations.

Departmental Costs

In many respects the departmental method of costing is similar to the process method. Its one big ad-

vantage over the process method is that it has a wider application and in most cases is more simple to operate. In many plants where the production order plan of costing is used, the departmental method could be used with equally effective results. In a plant making only one product, a carburetor for instance, this departmental plan will generally prove quite satisfactory, altho it can never point out in detail the operating deficiencies as clearly as will the production order plan.

Wherever the departmental plan is used, each operation in a department should be standardized, or as far as possible, made practically automatic, with labor paid upon a piecework basis. Its applicability to mass production, such as the manufacture of wire nails, screws, bolts, etc., is practically the same as the process plan. Each succeeding department is charged with the costs accumulated from preceding departmental operations. It must not be overlooked that very satisfactory results may be obtained thru the departmental plan of costing, even if the product could not be classified under mass production.

Effective departmentalization is a prerequisite to the successful operation of the departmental plan. In plants using this plan, a department does not mean an entire floor or portion of a building, but very often a small section of the plant devoted to one peculiar function, such as the making or shaping of one part of the product. This makes the department practically a production center. As in the case of production centers, the product can be adequately costed in each department, and the total cost, including labor, material, and overhead, passed on to the next department. This

departmental alignment of costs is practically the same as the process arrangement. Thru its application, however, it is not only possible to arrive at total costs for the finished product at final assembly, but parts costs can be established at the completion of any departmental process, so that no irregularities will occur when parts go into parts inventories for repair or guarantee sales.

In some plants, a greater refinement is necessary than provided by the departmental plan. Very often the costs of parts must be determined at various stages of completion. For instance, operating in the same department certain single machines may perform three or four operations in succession. It may be necessary to know the costs at the end of each operation. This happens very often on products involving punch pressing, embossing, drilling, shaping, etc., which is generally accomplished with special jigs and tools, the machine being set to perform either all the operations in succession or as few of them as necessary.

Trade demands call for some of these parts in various stages of completion so that they may have to be machined to a certain point only. In that case it is necessary to know the cost of the part at the end of any one or all of the operations. This demands the application of a process plan practically narrowed down to operations of single machines. Such an operation cost plan is necessary in the manufacture of automobile lamps and lamp parts for exterior and interior lighting. The costs for each operation must include its portion of labor, material, and overhead, because the article may go to the storeroom at any stage of its completion.

In plants where costing by individual machine operation plan is necessary, it is generally the case that hundreds of small parts are worked on, numerous styles and types must be created, all of which require many different operations. In such plants, the production order plan is impractical because production is continuous and the trade demands parts in almost every stage of completion. As a rule, automatic recorders are used on the machines combining several operations, so that the pieces produced in any combination of operations or of single operations are known. The material cost is a known quantity, and the labor time is recorded in connection with the particular articles machined. The machine overhead is charged to the product by the machine-hour method. No attention, except to the particular articles machined is therefore required, and the costs can be tabulated as soon as the machining is completed. To secure unit costs it will only be necessary to divide the total costs accumulated at any point by the number of pieces produced.

Chapter XV

FOUNDRY COST ACCOUNTING

Practically all large manufacturing plants making machines, tools, automobiles, or any products of iron or steel have their own foundries for making their castings. In such cases, the foundry is an independent unit of the plant, and its operations should in no way be merged with those of other departments, because its product—raw castings—is placed in the storeroom and accounted for in the same way as tho the material had been purchased from outside sources.

The completed castings form a part of the factory stores department inventory, and a record of all castings by pattern number is kept in the stores ledger controlling that section of stores. When castings are necessary they should be requisitioned from the foundry, the same as when the stores department requisitions on the purchasing department for articles to be purchased, except that instead of going thru the purchasing department the requisition is directed to the foundry superintendent. He maintains a stores ledger for raw materials, which he purchases from time to time, either thru orders direct or thru requisitions on the purchasing department.

The Material Requisition. An ordinary requisition form may be used by the stores department when ordering castings. The requisition should be in triplicate, the original and duplicate going to the foundry superintendent, and the triplicate remaining in the

stores department in an unfilled castings requisition file. A convenient form for this purpose is reproduced in Figure 50.

Castings Requisitions

Date...........19...... Requisition No.........

KIND	NUMBER OF PIECES	PATTERN NUMBER	DESCRIPTION	DATE REQUIRED	DATE FILLED

FIGURE 50.

The requisition may call for one or several kinds of castings. The pattern number indicates what casting is wanted, the date, and if necessary, the foundry order number should be inserted in the "date filled" column. A comparison of the date-required and date-filled columns provides a check on the foundry superintendent's efficiency and promptness.

The duplicate copy of the requisition should be returned to the stores department by the foundry superintendent with his notation. The stores department should receive a charge ticket from the foundry cost clerk for the cost value of the castings. This charge in the foundry will be to factory stores, and a credit, either to The Finished (In Foundry) Castings Account

or to foundry production in process. The entry in the general books should be the same, a transfer from foundry to factory inventory. If castings are made entirely for factory use and not for sale, no finished castings account would have to be carried by the foundry. All foundry cost charges should be to Foundry Production in Process. This account would be credited with the total cost of all good castings as finished, the corresponding charge being to Factory Stores.

Basis of Cost. Some foundry cost systems are based upon a per ton or per pound calculation, using the good castings produced as the divisor. Such a plan is not advisable because it in no way shows up the losses in spoiled or rejected castings, nor does it make allowances for the varying costs of molding, core making, or cleaning. It is far more practical to thoroly departmentalize the foundry and then work out the costs on a production-order basis. Special provisions should be made for the following departments which exist in all foundries:

1. Melting
2. Molding
3. Core making
4. Annealing (in malleable foundries)
5. Cleaning or finishing

Melting Department. In the melting department are the costs of raw materials and the cost of melting itself which includes the labor of operating the cupolas, open-hearth furnaces or crucibles as the case may be, as well as the overhead expense. The expenses of the departments which serve the melting department, such

as the blacksmith shop for repairing grate bars, pokers, etc., the laboratory for analyzing the iron and testing the product, and the slag mill for separating the iron from the slag, must be considered in connection with the total costs of this department. Whether or not the cost of pouring is to be included with melting or molding is dependent upon the foundry organization.

Controlling Raw Materials. Foundry cost accounting should start with a proper control over raw materials. Pig iron, for example, ordinarily should be kept in separate piles corresponding to the carloads received, and labeled with the car number in which it was shipped. This is not only necessary for adequate inventory control, but in order to check up thru the melts on the quality of the metal. The freight charges, cost of handling and storing should, of course, be added to the invoice price of all raw materials. The inventory records should have separate pages for each carload and account for them by car numbers. Whenever a melt is run thru, the requisition for material will be credited against the particular lot from which it is withdrawn, and charged as the metal cost of a production order. To this metal cost should also be added the time of the cupola tenders, an hourly overhead for cupola maintenance (insurance, taxes, depreciation, and estimated repairs on both cupola and building space), all cupola supplies, the fuel, the labor of the pouring gang, and the fixed charges on the ladles. This entire cost should be charged to separate production orders so that each will be charged with the costs of the melt which, of course, includes defective castings as well as good ones. The scrap value of the defective castings can then be credited against the entire charge,

leaving the actual cost of castings accepted on the order. The following record of costs for a melt is typical of most foundries:

Pig Iron, 10,000 lbs. @ .02		$200.00
Labor, cupola tenders		16.00
Cupola overhead		3.00
Fuel		25.00
Cupola supplies		2.00
Labor, pouring gang		21.00
Ladle overhead		1.00
10,000 lb. Melt		$268.00
Good Castings	9,000 lbs.	$241.20
Defective castings and sprues	500 lbs.	13.40
Cupola loss	500 lbs.	13.40
Total	10,000 lbs.	$268.00
Less scrap value of defective castings		10.00
Total cost of good castings		$258.00
Per lb. cost of good castings		.0286-2/3

The net metal cost of each good casting will be the per pound cost multiplied by the weight of the casting.

Molding Department Charges. In the molding department, all direct labor will be charged specifically to individual patterns. The molding department machine overhead, which includes the depreciation, maintenance, and power charges applicable to the molding machines, should be charged on the basis of the time which these machines devote to each production order. Superintendence, inspection, timekeeping, and other items of general overhead may be charged to orders in accordance with the direct labor hours expended on them.

As very few foundries use machines in the production of cores, the costs in the core-making department consist of the direct labor and the application

of the overhead on the direct-labor hour basis. These charges are applied to the cores made for the various orders coming thru.

Cleaning. In the cleaning operation, castings are tumbled or sand blasted to remove the molding sand adhering to them. In many foundries, particularly the smaller ones, separate costs of cleaning are not kept. This is not a good practice, because the cost of cleaning cannot always be fairly distributed to production orders on the same basis as other costs. No part of the cleaning is direct in the sense that it can be charged to a specific order. However, in cases where the labor is considerable, the individual castings orders may be charged with the direct labor and the cleaning department overhead may be charged either upon a machine-rate basis or on the basis of direct labor hours.

Hand cleaning has become a thing of the past. The operation in most cases consists in placing castings of all sizes and weights in a revolving steel barrel. It is a common practice to distribute the cleaning expense on the basis of the weight of castings cleaned. If more time is required to clean light castings than heavy ones, this method of distribution may not be practicable.

Finishing. Some castings require a finishing operation, such as straightening, punching, drilling, or reaming. The cost of finishing should be charged to the work requiring the additional operation. To do this it is necessary to treat all finishing labor as direct labor and to apply the finishing expense to orders on

which finishing work is done, on the basis of direct-labor hours.

Distributing Overhead. Overhead cannot always be considered as one large unit for distribution, but must first be distributed to departments according to space overhead, power requirements, etc., and should rarely be made on the basis of direct-labor hours distribution. But once applied to a department, the general overhead, with the exception of departmental machine overhead, may be distributed to product on the basis of departmental direct-labor hours.

After a foundry has been in operation for some time, departmental overhead distribution rates based on normal maximum production for each department may be established. The fact that the application of this rate does not absorb all the overhead indicates clearly that some departments do not work at normal maximum production. In such cases it would be possible to place the responsibility where it belonged by comparing the results against the established standards.

An effective departmental analysis of foundry costs will afford valuable information as to unit costs of melting, molding, core making, and cleaning. If the same patterns are being made there is little or no obstacle to standardization, and comparisons of similar runs will indicate the shortcomings of each department.

The relationship of general overhead disbursements to the volume of production, especially when considered in connection with past experiences, usually

affords an excellent index to the efficiency of the various departments. It happens at times that actual expenditures for overhead during some months greatly exceeds the overhead absorbed thru rates, because the expenditures may have been made to benefit future months. But do such expenditures when spread over the entire year equal or greatly exceed the total amount of overhead on which the departmental overhead rate is established? Or, if only a few months' operations are considered, was there a similar expenditure during the corresponding months of the period on which the rates were established? These are questions which, when fully investigated, will prevent snap judgments as to the adequacy or inadequacy of overhead whenever the rates, as applied to monthly costs vary widely from actual expenditures.

Inspection. Inspection is an important cost factor in a foundry. After the castings are cleaned, they are trimmed and inspected. The lugs and rough parts of a casting are knocked off so that it will conform in outline strictly to the pattern. A rigid inspection should be made at the time the rough castings are trimmed, because bad and defective work can then be thrown out, thus saving the added expense of annealing castings that would finally be rejected. An inspection report should be made of all castings trimmed and inspected. This report may show the date, order number, pattern number, and the pieces and weight of both good and bad castings.

Chapter XVI

WAGE SYSTEMS

In any industry the most effective results may be gained by fully considering the interests of the workers. Altho machinery has in many instances reduced labor to routine tasks, the maximum production is possible only where working conditions are agreeable and pleasant. An important, if not the most important, consideration is the wage-payment system. Altho very many labor disputes may be traced to the unreasonable and sometimes unscrupulous methods of organized labor, many disputes also result from a disregard of the rights and comforts of the worker by the management. In such plants the human element has been disregarded almost entirely and labor considered merely as a commodity. No incentives have been offered nor have any conveniences been provided for the comfort and welfare of the workers. Such conditions bring about discontent among the workers, and this has a disastrous effect on the volume of production as well as on the quality.

As a matter of fact, labor is just as essential to the successful operation of a plant as is capital. Workers should have some voice in factory matters and some goal to which to look forward. Otherwise they will lose themselves in the ceaseless monotony of long-drawn-out routine.

The Day-Rate System. The evolution of wage systems parallels the development of industry. The

oldest known wage system is the day wage. Men were hired at a certain rate per day, hence the old designation of the wage worker as the "day laborer." In the early days of industry when there was very little machine labor, the day-wage system was fairly adequate. In those days the work required a great deal of superintendence and inspection which consisted almost entirely of a physical supervision of the worker's efforts. It was supervised gang labor using hand tools. Each laborer, as a rule, performed much the same kind of work for days at a time so that a variation of rates was unnecessary.

The first modification to the day rate came soon after it was discovered that some laborers could turn out more and better work than others. Altho the day rate continued, there was a variation in the amount of daily pay for different kinds of work, and the separation between so-called "skilled" and common labor became noticeable. What we call common labor to-day is a survival of an old universal system when all were common laborers. To-day we think of common labor as unskilled, altho in those days such was not the case. In some plants, common labor, in the sense that the term is used to-day, is still paid by the day, week, or month, if it is of a very general character. The tendency, however, is to pay according to an hour rate based on definite information as to the tasks performed.

Paying by the hour, instead of by the day, probably grew out of a practice of shifting labor from one task, for which a certain rate was paid, to another where the rate was different. Again, the hourly rate grew

apace with timekeeping, and served as a precaution against idle time or slack work.

A day or hour-rate system is in most cases unsatisfactory and offers little or no incentive to labor. Unless coupled with the actual records of the various workers' productivity on certain tasks, it offers no reliable information as to labor costs. An efficient worker receives no more pay than does the mediocre or incompetent. It is only where the hourly rate varies with the performance on certain tasks that it is of practical value. Such a method is an improvement over the day or hour rate and might better be called a task rate. It fixes a certain rate based on a fixed production of certain quantities or pieces per hour. If not combined with a premium plan, such a method will usually result in performing up to standard only. If premiums are offered, workers falling below the standard will not be paid at the task rate but may receive compensation on the basis of a smaller hourly rate or in proportion to their performance. In order to work out to the best advantage, this plan should not be based upon hourly performance, but upon the average hourly performance of a period of hours or days, the average either equaling or exceeding the task requirements.

The strictly day-rate system offers little direct aid in cost finding, because production per hour may vary, as a whole or by men. Then too, it gives little or no clue as to the quantity or quality of output, and no reliable product unit cost can be obtained. The system is practical, however, for paying certain classes of indirect labor where time is the essential factor, and where definite results cannot be measured on an hourly

basis. Superintendents, foremen, watchmen, firemen, and repair men perform work which can best be paid by the day or hour. This does not imply, however, that their activities cannot be measured by some yardstick of efficiency.

Premium and Bonus Systems. Premium systems must not be confused with profit-sharing plans, because they have nothing to do with the ultimate net profit made by a manufacturer. They were introduced in order to stimulate production and to permit workers to share in any excess production over and above a certain standard requirement. The standard, under a premium system, usually consists of an established time for the completion of a certain task. If the worker can cut the time on the job, he is paid for a portion of the time he saves. This plan has proved quite effective, altho it is necessary thru proper time and motion studies to set a correct time standard. The time allowed must represent what may be expected of an average worker giving honest effort. But because of the danger of overestimating or underestimating what should constitute standard production, this standard should not be fixed until after a thoro time-study analysis has been made of the task. If the standard is so high that the average good worker can never do better than standard, or rarely attain the standard, then the plan will not succeed, as no incentive exists. If, on the other hand, the standard time can be easily made or reduced, the cost of production will be excessive, because the standard was incorrectly computed. No end of trouble will result as soon as corrective changes are introduced to raise the standard.

It has been contended by some that a combination bonus and premium system is a greater stimulant to labor than is the premium plan alone. Such a plan provides for a percentage increase over the hourly rate for all work done in standard time, and an additional bonus for all time gained by the laborer. If the worker reduces the time on which the regular hourly rate is based and receives a 50 per cent increase over the regular rate, the additional inducement is at once apparent. But this plan will not work out successfully unless the work is closely supervised by the departmental foreman and carefully inspected by an independent inspection department. Nor will it operate to any advantage if the flow of work to the machines or departmental centers is not constant. Materials must always be on hand, tools must be in prime condition, the speed of machines must be adjusted accurately, and every obstacle that has the slightest chance of slowing up production must be removed. These conditions are absolutely necessary to the successful operation of any premium or bonus plan or any combination of them.

Where any premium or bonus plan is in operation, it is advisable to pay the foremen a bonus based, not only upon the time saved in a department, but also on the basis of a reduction in overhead and in the rate of labor turnover. The quality of the products turned out, as well as reductions of time and costs secured thru advantageous rearrangements of machines and processes, should also be taken into consideration. In general the plan for extra rewards for efficiency, to be earned by either workers or foremen, is dependent upon factory organization and engineering. To make

the plan effective requires adequate power for all manufacturing equipment and machines, proper transmission of power, the right kind of machines and machine tools, constantly available materials, helpful supervision and inspection, logical departmentalization and machine arrangements, proper routing of materials, and last but not least, agreeable and wholesome surroundings.

Piece-Rate Systems. Piecework rates may be advantageously used in connection with unskilled tasks where little intelligence is required of the operator. In such cases, if the piece rate is proper, production is considerably stimulated because the incompetent and careless worker can be readily detected and eliminated. Under a piece-rate plan, the laborer must also be guaranteed against loss arising from causes beyond his control, and, as in the case of premium systems, the piece rate must be fixed by expert investigation. Cutting piece rates always leads to disturbance and dissatisfaction.

A differential piece-rate system has been quite successfully used in plants where production is on a piece basis and does not require skilled labor. It provides for a certain rate per piece if a predetermined quantity is produced, and an increased rate per piece if the quantity is exceeded. To illustrate: A worker receives 5 cents per piece on a daily production of 50 or less pieces. If he produces more than 50 pieces, but under 60, he receives 5½ cents per piece, or if his production exceeds 60 pieces, he receives 6 cents per piece. The piece-rate plan is not advisable where skilled labor is involved, and wherever used it must be combined with the very closest kind of inspection.

Miscellaneous Wage Systems. In some plants workers are paid a certain rate per hour for a fixed number of pieces machined per operation. If they produce more they are allowed either an additional compensation per piece on the increase, or the rate for the hour is increased. In some plants the time element is disregarded entirely, and a rate based on the completed job as made. The worker's increased earnings will depend upon the speed with which he completes the job. There are also many modifications and combinations of time rates and piece rates, a worker sometimes performing under both plans. Some processes or operations must be put on a time basis, while others are entirely suitable for piecework. All plans should have the gain-sharing element in order to speed up production.

Profit Sharing. A few manufacturers operate their plants on the theory that labor and capital are partners of almost equal importance. They take the stand that labor should receive not only a wage corresponding to the executive salary of the capitalist, but should also share in the profits of the undertaking in the same way as capital receives dividends. This recognizes in labor a profit-making element of much the same nature as capital. It considers labor as an investment of human energy or human capital, entitled to a reward in excess of the price for which it can be purchased on the open labor market. An industrial organization is a complexity of forces. All forces contribute, thru cooperation and coordination, to industrial success. They should all receive consideration as profit-producing elements and share proportionately in the results to which they contribute.

Under profit-sharing plans, labor is rewarded by either an actual distribution out of the annual profits, or by shares of the capital stock entitling it to dividends. Some manufacturers distribute a portion of their profits by giving their employes a bonus or special reward based on their annual wage. As industry progresses, a larger appreciation of labor's efforts will result. With such appreciation will come a fuller understanding on labor's part of its duties and obligations to the public. The social unrest, so apparent everywhere, must eventually disappear and make room for a system of true cooperation between capital and labor, the two great partners in business and industry.

Chapter XVII

THE APPLICATION OF SELLING AND ADMINISTRATIVE EXPENSE TO PRODUCT

Altho cost accounting is confined to the computation of factory costs, that is, the manufacturing costs, price fixing demands the complete consideration of those additional expenses necessary to market the manufactured product and to administer the general affairs of the manufacturing business.

Very often, altho a cost system may be nearly perfect and all possible factory economies have been effected, a manufacturer may, nevertheless, show losses due to inadequate control over his selling and administrative expenses. For this reason the same keen analysis of selling and administrative operations should be made that obtains in factory cost matters. In fact, unless the same principles are applied in controlling selling and administrative costs, the entire advantages gained thru efficient low cost production may be lost. In order not to overlook this danger some manufacturers have actually added selling and administrative costs to factory overhead, a course hardly to be recommended from an accounting standpoint. A manufacturer is in business primarily to sell and one might just as logically consider all factory costs as selling expense. We must always distinguish carefully between the cost of manufacturing the goods sold, the cost of selling the goods, and the costs of administering the general affairs of the business, which reflect its relations to the general public. Selling and

administrative costs should, therefore, always be kept entirely distinct from factory cost. Their tabulation and analysis should not form a part of the work of the cost accounting department.

All accounting, however, both cost and general, should be under one responsible head, who should see to it that the same principles of analysis and economy are applied to the entire operating costs of a business; in other words, we wish to recommend a selling and administrative cost department.

Knowledge of Costs Essential. Selling and administrative costs depend largely upon a correct knowledge of factory costs. When once the factory cost of a product is known, it becomes a fairly simple task to fix the amounts that may be spent for selling the product and for administrative purposes, so that a profit may still ensue from sales. Very often the accurate knowledge of factory costs is the salvation of an industry, because such knowledge forces the introduction of economies and efficiency in selling and executive functions.

Analyzing Past Performances. A knowledge of what may be allowed for selling and administrative costs can generally be gained thru an analysis of past performances. Let us assume a manufacturer making three distinct types of product, A, B, and C, and that past conditions have indicated that these products must be sold at prices averaging $1,000.00, $980.00, and $900.00 respectively (a continuation of the same trade conditions being apparent). During the year the sales reflected the following conditions:

Type	Quantity Sold	Average Unit Sales Price	Total Sales
A	200	$1,000.00	$200,000.00
B	250	980.00	245,000.00
C	300	900.00	270,000.00
	750		$715,000.00

The manufacturer concludes that since his plant was worked normally, he cannot materially increase his sales for the coming year and, therefore, estimates that the sales will be practically the same in quantities and values. He has determined, however, that he must make 10 per cent on sales as a net profit, after making due allowance for interest on borrowed money, which amounted to $3,000.00 for the previous year (6 per cent on an average of $50,000.00). In order to assure himself of a 10 per cent net profit on sales, he must know his factory costs. In fact, all his calculations would be mere guesses if he did not. We are assuming that he has an accurate cost system which revealed the following facts to him for the past year:

Type	Quantity Sold	Average Unit Cost of Sales	Total Cost of Sales
A	200	$600.00	$120,000.00
B	250	550.00	137,500.00
C	300	500.00	150,000.00
	750		$407,500.00

A comparison of the sales with the cost of sales furnishes a basis on which the available budget of selling and administrative expenses for the ensuing year can be computed.

His gross profits on the three types of product sold were as follows:

Type	Sales Price	Cost of Sales	Gross Profit	Per Cent to Sales
A	$200,000.00	$120,000.00	$ 80,000.00	40.00%
B	245,000.00	137,500.00	107,500.00	43.88%
C	270,000.00	150,000.00	120,000.00	44.44%
	$715,000.00	$407,500.00	$307,500.00	43.01%

If he is to make 10 per cent on his sales he must make $20,000.00 on Type A; $24,500.00 on Type B; $27,000.00 on Type C, or a total of $71,500.00. In other words, he must meet all his costs, his interest charges, and his selling and administrative expenses out of the difference between $715,000.00 and $71,500.00, which is $643,500.00. His factory costs are apparently known as amounting to $407,500.00, and his interest charges are estimated at $3,000.00. The balance available for selling and administrative expenses must be computed as follows:

Budget Available for all costs and expenses		$643,500.00
Deduct Factory Costs..........	$407,500.00	
Interest Charges......	3,000.00	410,500.00
Balance Available for Selling and Administrative Expenses		$233,000.00

To put the matter concretely, all selling and administrative expenses must not exceed $233,000.00 for the year if a net profit of 10 per cent on sales is desired on a volume of $715,000.00. Having allowed $233,-

000.00 for selling and administrative costs it becomes a simple matter to determine how much of this is available for expenses of a variable nature, such as advertising, for example. Salaries of salesmen, commissions, officers' and office salaries are more or less fixed so that when a provision has been made for these expenses, the remainder of the budgeted amount may be considered as available for the variables in selling and administrative expenses.

We have seen that all the calculations given here are based upon one thing, namely, a knowledge of costs, and that all estimates or calculations would be futile without that knowledge. In any calculation, however, no matter how certain one may feel of a continuation of past performances, certain amounts should be budgeted for contingencies; an entire allotment should not be fully hypothecated. Only the minimum necessary to provide for efficient management and selling should be provided and every effort made to determine that maximum results are being obtained from the expenditures once they are in progress.

Application of Administrative Expense to Products. If, as indicated, a net profit of 10 per cent on sales is desired, it is presumed that that percentage is expected on each type of product sold. It is, therefore, possible, if factory costs on each type are known, to make proper provisions for at least the amount of selling expense necessary to market adequately each type, especially if separate selling forces are employed for each type, or where each type may represent a different seasonal product. When the sales force sells all products at all times, it is not always feasible to at-

tempt a detailed application of selling expenses to the individual types of product, altho the efforts of salesmen must be directed so as to secure the needed proportioning in sales.

If factory cost accounting does anything it must give the cost of sales for each type of product manufactured. In beginning the application of selling and administrative expenses we have a definite starting point, which is the factory costs of each and all the various products manufactured. The application of selling expenses is somewhat simpler than the application of administrative expense, and it is necessary to secure an analysis of administrative expense first.

Analyzing and Allocating Administrative Expense. Administrative expense is divisible into the following groups:

1. General Administrative supervision over all activities of a business:
    - (a) Purchasing
    - (b) Production
    - (c) Selling
    - (d) Financing
    - (e) Accounting and Statistics.
2. Financing, Credits, Collections.
3. Legal and Corporate Expense.
4. General Office Expense—Telephone, Telegraph, Stationery, Postage, etc.
5. Accounting—Cost and General.

Taking this grouping of administrative expense as fairly typical, our next problem is to distribute it on some fair basis as far as that is possible. In dealing

with general administrative supervision (our first group) the question of its proper proration is an important one. Do the executives give their time equally to the different elements of supervision, or has each executive control over a single element or a logical combination of several elements? If, for example, the general manager gave his full time to purchasing and production, and the treasurer devoted his time to financing exclusively, leaving to the secretary the corporate records and accounting, and to a first vice president the supervision of sales, the task of loading supervisory expenses would be quite simple. In that case the general manager's salary and expenses would become part of factory overhead; the treasurer's salary and expenses would be charged to the second group of administrative expense, i.e., financing, credits, and collections; the secretary's time and expenses would be divided between Group 3 (legal and corporate expense) and Group 5 (accounting); and the first vice president's activities would be translated into a charge to selling overhead. Departmentalization of this kind exists in many industries; in fact, a common plan of organization provides for vice presidents, under the president and board of directors, who have charge of the various activities such as production, marketing, financing, and, possibly, personnel arrangement.

For the purposes of this discussion we will assume such an organization with its various subdivisions, as illustrated by the chart shown in Figure 51.

Using our chart, we must start with the expenses and salaries of the general manager and his direct assistants. If possible, these outlays should be allo-

cated to the functions with which general management is concerned; if we assume all the functions to be of equal importance, then one-fourth of the general management cost should be charged against each of the four general operating groups, which are production, marketing, financing and personnel. If these groups are of varying importance, the relative importance of the groups must be fixed upon some arbitrary but common-sense basis and the distribution made in accordance.

The portion charged to production will become part of the factory overhead; we need not worry about this element, because it will appear in the various product costs of sales. We must deal with the portions charged to marketing, finance, and personnel, and for the time being may consider them as marketing, finance, and personnel overhead expenses, respectively. In view of the fact that accounting (both cost and general) and statistical work may be viewed as existing primarily and intentionally for general management purposes, the salaries and expenses of the entire accounting department should be included as part of the general management outlay, altho it will probably be distributed to the various functions on an independent basis. It would be a simple task to determine all direct charges for cost accounting so that that portion could be readily charged to the production unit as factory overhead. The remainder of accounting expense should be charged to General Administrative Overhead.

General Administrative Overhead. In view of the fact that selling expense, both direct and indirect, should be allocated to product as closely as possible,

FIGURE 51

Organization Chart Showing Departmental Activities

and that all general overhead should, as far as possible, be analyzed into portions chargeable to the various functions, our second step is to make such an analysis and distribution. Our components for this task are the following:

1. The expenses of the personnel department, which also now includes some general management expense.
2. The expenses of financing (to which has been added a portion of general management and personnel expense).

Personnel expense may not exist in all industries, but many progressive manufacturers feel that personnel relations are of sufficient importance to warrant the creation of a department whose tasks are to promote proper relations between the employes and the employer, to foster such welfare work as will produce agreeable working conditions, and to generally cement the individuals of the various groups into a harmonious whole; in other words the personnel department exists primarily for the purpose of developing an "esprit de corps." The personnel department expense, confined largely as it is to the affairs of individuals in their relation to the industry as a whole, should be distributed to the various groups or departments (production, marketing, and financing) on the basis of the average number of employes in each department.

Financial expense exists in order to properly finance the various functions and activities of a business, and its distribution should be on the basis of the financial requirements of these functions. Whatever earnings may accrue to the finance department may well be deducted from its expenses so that a net amount may

receive consideration. After applying to the marketing division the expenses of maintaining a credit and collection department the remainder of financing expense should be distributed to the marketing and production departments, respectively, on the basis of the direct expenditures of these departments. The direct costs for this purpose consist of the total pay rolls, purchases, insurance, taxes, and all cash expenditures in the production department and the total selling pay rolls and advertising disbursements in the marketing department. The amounts of financing expense thus absorbed will become production overhead and marketing overhead.

Our analysis and distributions thus far have left us only two functions to deal with, namely, production and marketing. After all, are not these two functions the real cardinal functions of a manufacturing business, and are not all other activities contributory to these two? We do not have executive functions merely to go thru the motions of administration; we do not make loans or raise money merely because we are able to do so. A manufacturing business is administered, controlled, and financed in order to produce goods and to sell them. It is for this reason that we have finally loaded all administrative and financing expenses onto production and marketing. In other words, after applying whatever is proper to the production department, the remainder of all so-called "commercial" expenses must be regarded as necessary to market properly the commodities produced. In fact, there is nothing else to do. After goods have been produced the only problem remaining is the distribution of the product, and all efforts are given either directly or indirectly to accomplish that distribution.

To summarize our plan of distribution up to this point, we now have the following outline:

1. The production department has been charged with all direct costs, a portion of general management expense, a portion of personnel expense, and a portion of financing expense. All these costs will appear in the cost of finished product and in the cost of sales of the individual types of products manufactured.
2. The marketing department, which includes the direct and indirect expenses of its own operation, has been charged, in addition, with portions of general management, personnel, and financing expenses.

These two departments now include all expenses of a direct nature, as well as the entire expense group which is usually characterized in accounting as administrative expense. The cost department furnishes us with the entire cost of sales, including that portion of administrative expense absorbed by the production department, so that nothing further remains for discussion except the distribution of marketing expense to products sold.

Applying Marketing Expense to Product Sales

The application of marketing expense to the various types of products sold will depend almost entirely upon the character of the selling organization and its advertising. To illustrate this point we will assume two types of organization, one in which each salesman sells only one type of product, and another in which each salesman sells all products.

Where Each Salesman Sells One Type of Product. Under these conditions the direct road-selling expenses may be lodged against each product sold and an aver-

age cost per unit established. Such an average will be created by taking the total units of each product sold during a normal year in a given territory by the various salesmen selling each particular product, and dividing the number of these units into the total annual road expenses—salesmen's salaries and expenses. If the sales manager devotes his time exclusively to the supervision of salesmen, then his salary and expenses should be distributed first to the various territories in proportion to the road expenses indicated for the various territories and, secondly, to the products sold within each territory on the basis of the product road expenses distributed to such product sales. If the sales manager also devotes his time to advertising, then, only a portion of his salary and expenses will be prorated as suggested; the proportioning between selling and advertising should probably be on the basis of the relative annual costs of these two functions.

Distributing Advertising Expense. Advertising expenses should be distributed in accordance with space utilized by the various products in trade journals, newspapers, or catalogs, altho the accounting procedure in making the distribution may differ with the various forms of advertising. It may, as in the case of road expenses, be first applied territorially and then to product; this would be advisable in the case of catalog circulation. Catalogs should, of course, be handled as an inventory account, and selling expense charged only as the catalogs are mailed; in mailing, the territorial divisions should be noted. The products illustrated and described in the catalog should be charged on a space basis at the time the credit to catalog inventory is made. The annual expense thus created

could be translated into a unit product catalog advertising expense. Newspaper and trade journal advertising, unless deferred for special reasons, should also be charged to product in much the same way. General advertising or promotional advertising must be prorated, either on the basis of the costs of direct product advertising, or upon a combination of direct product advertising and direct-road selling costs.

The marketing department overhead expense, composed of portions of general management and personnel department expense plus any indirect expense created in the marketing department itself, should, as far as possible, be distributed to product on the basis of the direct selling costs, which may be either the direct road-selling costs for each product or a combination of the latter with the direct product-advertising costs.

Where Each Salesman Sells All Products. To secure an approximately accurate loading of direct road-selling expense to individual products, it is necessary for each salesman to record at least weekly the time he has devoted in securing orders for each product. Altho such a plan would have its limitations, it would be far better than a proration on the basis of relative sales, either by values or units. Again, a plan based upon relative costs of sales would be unfair, because the costs of producing articles bear no relation to the efforts of selling. The proposed plan calling for a weekly distribution of time need not be made burdensome to the salesman if the requirements are reasonable. The salesman is the best judge of his own activities, and if his honesty of purpose may be assumed,

there is little reason to doubt that his time reports would furnish the best basis for his expense distribution to product.

Even where salesmen sell all products, the advertising can be split up in the same manner as that discussed. Advertising would probably be individual. Again, as in our first case, all overhead selling expense should be prorated on the basis of the direct selling costs per product.

Unit Selling Cost per Product. After having applied all marketing costs to product, a unit selling cost per product can be readily determined, both for each product generally, as well as for each product territorially. Our next problem is to provide the proper accounting procedure.

The author recommends the following procedure:

1. Charge all expenditures for marketing to a general ledger controlling account entitled "Deferred Marketing Costs," the latter controlling account to be properly analyzed and detailed in an analysis ledger, as follows:

    (a) D. M. C. General Management Expense Portion.
    (b) D. M. C. Personnel Expense Portion.
    (c) D. M. C. Financial Expense Portion.
    (d) D. M. C. Sales Management Expense.
    (e) D. M. C. Advertising.
    (f) D. M. C. Salesmen's Salaries.
    (g) D. M. C. Salesmen's Expenses.

(D. M. C. stands for Deferred Marketing Costs.)

2. Charge to a controlling account entitled "Product Marketing Costs," the predetermined selling cost per

unit for all units of the various products actually shipped and billed each month, and detail these charges in an analysis ledger, as follows:

(a) P. M. C. Product A
(b) P. M. C. Product B
(c) Etc.

(P. M. C. means Product Marketing Costs.)

The offsetting credit to the preceding charge might well be called "Provision for Product Marketing Costs," and represents that portion of the Deferred Marketing Costs applicable to actual shipments made and thus absorbed. The credit is not made to the detailed deferred charges in order that the actual expenditures reflected in the deferred charge accounts may remain intact, thus obviating the need of later expense analysis when the regular profit and loss statement is prepared in standard form.

At the end of any year, if the predetermined unit cost of marketing has been approximately correct, the Deferred Marketing Costs Account will be in close agreement with the Provision for Product Marketing Costs Account. At any rate they must be closed one against the other. The differences after closing will represent either under or overabsorbed Marketing Costs.

To make the proposed plan of marketing costs distribution of real value, it is essential that a detailed budget system be provided. The budget would naturally be based upon much the same data as used in establishing the annual product unit marketing cost. The budget should provide for monthly and, in some cases, seasonal control. A budget, coupled with a plan

or plans for measuring the efficiency of salesmen and of advertising, would certainly, in time, create not only standards of direct selling but of general marketing management.

In connection with any plan for the tabulation of marketing costs, it is essential that definite forms for measuring selling efforts be installed. We have indicated how the broad general allotments for selling and administrative expenses may be fixed. These general appropriations should be budgeted in detail, so that specific amounts, based upon careful investigations, may be alloted to cover the marketing costs for each product in each territory. To judge how effectively the funds are used implies a careful check up of all marketing efforts. Real standards of direct selling must be created and care must be exercised in varying these standards in accordance with changing and variable conditions. For example, a manufacturer having only one plant and a wide territorial distribution of his product cannot measure the efforts of all his salesmen by one standard. He must divide his sales field into zones representing a home zone, a zone of normal competition, and a zone of difficult competition. Salesmen must be grouped according to these zones. In all events, the criteria of a salesman's efficiency are the gross profits he can make for his employer on a standard or better volume, and the selling costs per unit of product.

A salesman's efficiency sheet must show at least the gross profit and the unit selling cost by zones; a comparison of salesmen within the same zones will then furnish a clue as to the relative value of services. Variations from established zone standards should

also appear on this salesman's efficiency sheet and, in addition, it would be desirable to indicate the delivery date of orders, the rating of the customers, and cancellations. The latter information will indicate the salesman's ability to take orders for prompt delivery, to sell to customers of financial standing, and his power to permanently impress the customer.

It is not our intention to give the impression that the recommended procedure is the "sine qua non" of marketing costs distribution. Our idea has been rather to suggest possible methods of proration under certain assumed conditions, feeling that thereby the necessary modifications may suggest themselves where conditions are different. At any rate, it is the hope of the author that this virgin field of "Marketing Cost Accounting" will receive the earnest attention of cost accountants who have thus far felt that their prerogatives were confined entirely to the Production Costs.

Selling and Administrative Efficiency. The object of all accounting is to cut expenses and costs and to increase efficiency. It is just as essential to secure statistics on the operations of the sales department as it is to secure reports of labor time in the factory. In fact, the entire problem of selling bears a close resemblance to factory costs. The sales department starts with the finished product as its material cost; to this is added direct selling expense (the efforts of the salesmen), corresponding to factory direct labor, and selling overhead, which embraces the expense of sales management, advertising, and general sales office and branch office charges. The materials to be sold must, as in the case of factory inventories, be properly balanced to harmonize with market conditions.

The salesmen must operate in accordance with certain standards of performance, and the selling overhead must be kept at a minimum and must also be related to the direct efforts of selling. The active factor in selling is, of course, the salesman, and the whole problem of sales cost accounting must be centered about this factor. The sales department should, therefore, keep salesmen's cost or efficiency sheets showing the performance of each salesman month by month.

Salesman's Efficiency Sheet. A salesman's efficiency is not to be measured by volume of sales, but by the amount of gross profit he is able to earn for his company. He cannot be held responsible for the net profit of his employer, because many factors for which he is not responsible enter to cut down gross profit on sales; but provided the proper sales price is given, the product is up to standard, and market conditions are normal, the salesman's efforts should be judged by the gross profit he is able to realize on his sales. A proper form of salesmen's efficiency sheet should show the following:

1. The prices obtained for each type of commodity and the gross profit made on sales of each type.
2. The sales expense applicable to each type and the unit cost of selling.
3. The cost per dollar of sales (by types).
4. The gross profit per dollar of sales (by types).
5. The territory or zone in which the sales are made.
6. The comparison of actual selling costs with predetermined zone standards.

It is to be noted that each salesman's efficiency sheet should indicate the territory in which he sells. This

distinction is of vital importance, because salesmen in different territories must be subject to a different efficiency test than salesmen in the same territory. Selling conditions vary more or less with sales territories. In certain sections, unless freight charges are adjusted to meet competitive prices, it is decidedly more difficult to make sales than in other sections. There are, in addition, sectional prejudices, and the elements arising out of the proximity of the plant to the consumer; proximity means prompt shipment and, to a certain degree, more detailed attention to complaints and local market conditions.

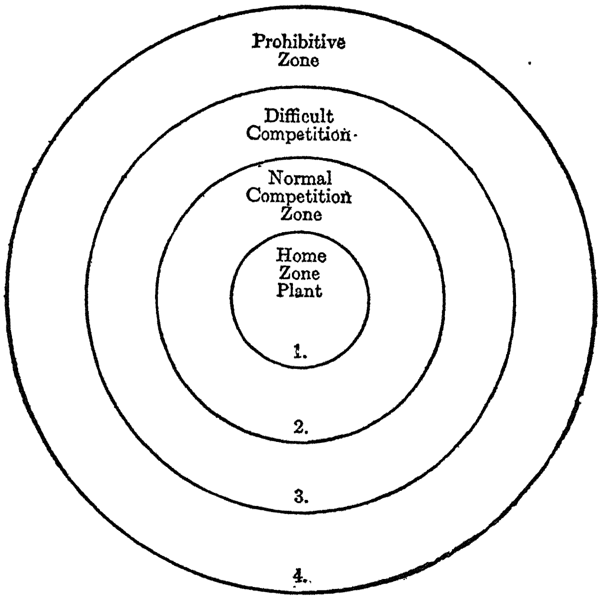

FIGURE 52. SELLING ZONES.

The selling activities of a manufacturing business having only one plant may be best illustrated by means of circular zones, as shown in Figure 52.

The center, or home zone, requires little, if any, selling effort, because of the publicity which naturally arises from proximity; direct selling may be unnecessary in this zone, orders coming in automatically, or at least without any particular effort. Salesmen may not be needed in the home zone, altho some advertising is probably advisable. In the normal competitive zone it is assumed that the manufacturer meets on an equal footing with his competitors and only normal selling expenses should be required in order to effect profitable sales. In the third zone, altho profitable sales may be possible, extraordinary efforts will have to be made. In the last zone, the expense of doing business is prohibitive and, therefore, represents a zone which should not be entered. These zones, generally, will represent proximity or distance from the main plant, altho because of local reasons, such as limited competition, some of the zones may have humps in them to represent actual territorial enlargement.

Formulating Standards. In formulating salesmen's efficiency standards it is necessary to compare salesmen operating in the same zones; it would be manifestly unfair to compare results obtained by salesmen in the home zone with the results of other salesmen operating in the second or third zones. The establishment of zones and the grouping of salesmen along zone lines are functions devolving upon the sales manager, who should be a close student of territorial sales conditions. A zoning of salesmen, combined with a salesman's efficiency sheet, should insure an adequate check on individual selling performance. The sheet should prove satisfactory, because it checks the salesman in almost every particular. His daily sales appear, and

it should show the delivery date, thereby indicating the salesman's ability, or lack of it, in securing prompt delivery. It should also show all cancellations, thereby, to a very large degree, designating the salesman's power to permanently impress the customer. The rating of the customer should also be indicated, thus showing whether the salesman possesses the ability to sell to reputable well-established concerns, and of his coöperation with the credit department. Sales on credit made to weak customers are generally not sales at all, because in the larger number of cases such orders will and should be rejected by the credit department.

The salesman's efficiency sheet will clearly show up the real salesman, as distinguished from the order taker. The conception of good salesmanship has too often been associated with volumes of orders. Where selling prices are fixed, it is true, that volume is the index of efficiency, everything else being equal. But where a salesman has considerable leeway in quoting prices, volume, after setting up a stipulated minimum, is secondary, and the index of performance is the profitableness of the sales. To illustrate: Suppose Salesman A sells 100 dining room tables at $15.00 each during a given month; his sales will aggregate $1,500.00. Let us assume that his salary and expenses amount to $250.00, which will give a unit selling cost of $2.50 per table. If the table costs $10.00 to make and $1.00 must be added for administrative expense, interest, etc., the total expense to make and sell will be $13.50 per table, leaving a profit of $1.50 per table, or $150.00 on the whole order. Now let us take Salesman B, who sells 80 tables of the same type at $20.00

each, or for $1,600.00. Let us assume his salary and expenses to be $260.00 or $3.25 per table. If, then, we add the cost to make ($10.00), the cost to sell ($3.25), and general expenses ($1.00), we have a total cost to make and sell of $14.25 per table; this, deducted from the selling price of $20.00 per table, gives a per table profit of $5.75 or $460.00 for the lot of 80. In other words, B, at a higher selling cost and smaller volume, realized $310.00 more profit for his employer than A.

The above illustration, altho somewhat extreme, shows that selling efficiency does not always go with volume; it also shows that the salesman having the highest per unit selling cost is not necessarily the poor salesman, but very often the best. Categorically speaking, the salesman who makes the largest profit for his company is the best salesman.

Building Goodwill. In connection with the problem of selling efficiency, we come in contact with another which may or may not have a decided bearing upon a salesman's future record and upon which quite complete knowledge should be available; how much sales promotional work is performed by the salesman and what are the results? A man may indeed, thru a combination of peculiar circumstances, be unable at times to secure even a minimum of required orders, and yet may, thru his ability as a sales promoter, build up goodwill for his concern, which will yield exceptional business in the future. This condition has often led the author to believe that there may be a considerable field for purely personal "in the field" sales promotion, not resulting in immediate orders but certainly preparing the field for that more dynamic type of individual—the salesman.

In order to judge of a salesman's efforts, more is needed than a statement of actual results obtained in the form of orders. A daily report form should be provided which will yield the following information:

Names, addresses, rating, and local information for all houses visited (including present customers).

Orders secured from present customers.

New customers.

Reasons given by those not ordering.

Sales methods used.

Coöperation from head office required or not.

Local trade conditions.

Time actually spent in promotional work and in taking orders.

From the schedule of daily activities given, it may be possible each month to charge part of the salesmen's salaries and expenses to sales promotion instead of all to the sales actually effected. It is always wisdom to know results that come from expenditures of all kinds, and if salesmen are forced into promotional activities thru lack of immediate orders, these activities should be traced to their culmination, and the information furnished by the salesman should be "followed up" and at the same time "checked up."

The application of advertising expense to types of product sold is fairly simple, but the measurement of results obtained is an entirely different and rather difficult problem. Advertising expense, whether finding its application in pages of trade journals, newspapers, or catalogs, may properly be charged against types of product, on the basis of relative space devoted to the various types; but the effectiveness of advertising which will naturally determine its form and extent is the real problem for investigation.

Too many concerns assume that certain results are traceable to advertising. It is true, of course, that advertising of any nature will, if it does nothing more, give more or less publicity to the products advertised and to the concern that is advertising. But an efficient advertising manager wants to check up more definitely, and desires to know, as far as possible, the direct results that come in the form of actual orders. Various devices are being employed to induce the purchaser to indicate that his order resulted from either a specific advertisement or from his knowledge of the product gained thru general publicity. A discussion of what these devices are is hardly apropos in a work of this kind. It is to be recommended, however, that in the launching of any advertising campaign, the following factors be thoroly considered:

1. The proper media, such as trade journals, catalogs, etc.
2. The circulation of the media, both as to number and class of subscribers, and in the various sales territories.
3. The market conditions which will indicate the wisdom of advertising or of not advertising at a given time.
4. The territory chiefly served by the advertising media.
5. The effect of the advertising upon direct selling, and whether the advertising is to secure mail orders or to assist the sales force.
6. The results previously obtained thru past advertising policies.
7. The kind of appeal which may be expected to yield the best results; this recommendation implies experimentation and assumes a variable mental attitude on the part of the buying public, variable both as to time and place. Changing economic conditions will naturally affect the attitude of prospective buyers to the appeal made.

8. The proportioning of advertising expense, as between trade journals, newspapers, catalogs, etc., and the securing of a proper balance in these various advertising activities.

Administrative Costs. The expense of management is one of the most elusive elements of operating costs; there seems to be no standard of any kind, and every possible variation exists in the nature of services rendered, the duties assigned, and the compensation for services. Yet, in order to have a successful industry, there must be some kind of proportion between administrative expense and output. If the management is not in control of the capital (which is rare), the salaries for executives may be provided thru a budgetary process so that the largest possible profit might inure to the stockholders. In a great many corporations, however, salaries paid to executives are not primarily for services rendered, but because of stock control; in reality, many salaries are virtually profit distributions. Salaries of executives in close corporations are rarely a measure of services. A company with many stockholders and without a marked concentration in stock ownership it would seem, would be most interested in efficient but yet relatively inexpensive management, because the existence of both efficiency and low costs in administration would increase profits and thereby insure larger dividends.

The stockholders in American corporations seem to take so little interest in the affairs of the corporations, however, that some of the most flagrant cases of mismanagement are found in the very corporations where the stockholders could, if they wished, exercise the greatest control; their control, in most cases, seems to

come to the fore only after the corporation has failed to pay dividends or is actually on the rocks. The reasons for this condition are quite apparent, however, when we consider the nation wide distribution of stock holdings and the inability of stockholders to attend meetings under such conditions. An organization of stockholders in every corporation, expressing its will thru a committee, might be of real value as a check against extravagant or inefficient management.

Our Blue Sky Laws have, of course, helped the situation somewhat in preventing the financing of "wild cat" companies, but they do not adequately protect the stockholder after he has made his investment in an approved security. The Federal Revenue Act regulating the amounts deductible as salaries paid by corporations has been of rather negative value in that its provisions are for income tax purposes only; larger salaries may actually be paid, even tho they may not be fully allowed when computing taxable income.

Stockholders Should Be in Control. In the opinion of the author, no real standards for executive services and remuneration can be set until the management of corporations is fully controlled and guided by the stockholders directly or thru stockholders' committees. We need, in this country, legislation similar to the English Companies Act, and until we have such legislation every imaginable absurdity in executive salary variations will continue to exist.

In the preceding discussion we have had in mind only the chief executive positions. Minor officials, department heads, and the office help are employed on a competitive basis, so that for them, standards of com-

pensation, at least, are possible. Standards of efficiency for these minor positions, however, must be created by the chief executives, and the standards for the latter will depend upon their ability to create proper standards for the various departments under them. If the chief executive is weak, then, probably, the entire organization will be weak, and not until the chief executive becomes flagrantly incompetent or failure impends will the proper remedy become evident if it does so at all. An incompetent executive having stock control is a hard case to handle and cannot generally be removed except as part of the debris resulting from industrial failure.

Logically, it is the duty of every group of stockholders to determine the personnel of management, and to impose the proper duties and responsibilities upon that personnel. Following this assignment, it becomes the duty of the management to provide efficient administration in the following manner:

1. By harmonizing the relations of all factors and individuals in an industrial body so that all will work automatically towards a common goal.
2. By absolutely fixing responsibilities for the various functions of an industry, thru the localization of specific duties to the various departments or operating organs.
3. By giving general supervision of the various functions of a business to certain officers or committees, each of these latter to be the final court of appeal concerning matters under their supervision.

Selling price, under competitive conditions, must, as a rule, be made to include only the following items:

Cost of Sales or of Production
Administrative and General Expenses
Selling Expense
Profit

Figure 53 presents graphically the four elements of the selling price. This chart shows that before the selling and administrative expense can be properly allocated to the various products, the factory cost of sales must be known. Altho the selling and administrative expenses in this chart are distributed on the basis of cost of sales, it is, nevertheless, important to study specific conditions and modify this procedure in accordance with suggestions presented in this chapter.

If a company is short of capital it must, as a rule, consider the interest on borrowed money as a part of the profit element in the sales price, because it cannot hope to enlarge that profit element in the face of prices made by competitors fully endowed with working capital. In fact, it is questionable whether any financial expenses should be considered in price making; ordinarily, when competition is keen it would be suicidal to do so. This condition will emphasize the need of adequate, permanent financing thru the sale of more capital stock.

A great deal of business depression is caused in manufacturing, thru efforts to include in sales price the cost of unused capacity or unearned burden, thus trying to load upon the buying public a business loss which in no way affects the costs of the limited number of commodities actually produced. The effect of such a policy is generally the temporary destruction of the market with the result that production becomes still further limited and that unused capacity increases. It

is foolhardy to expect the public to purchase unearned burden; they will reject it and thus create even more unearned burden in the future. Prices made upon the basis of actual used capacity will be correct prices, and unless unusual business conditions exist, should produce sales; the greater the sales, based upon the inclusion of real costs, the smaller in turn will the unearned burden become. Much of the acute business depression of recent years, in the author's opinion, can be directly ascribed to the efforts of manufacturers and merchants to recover both unused capacity costs and business losses from the buying public, and the consequent refusal of the public to buy.

FIGURE 53

How Selling Price Is Determined

Chapter XVIII

THE VALUE OF COST ACCOUNTING TO MANAGEMENT

The value of cost accounting to management depends upon a number of factors, foremost of which are the following:

1. The nature of the reports submitted to the executive by the cost department, or the general accounting department.
2. The information yielded by the cost accounts.
3. The proper organization for securing prompt remedial action in correcting weaknesses in factory operation.
4. The constant coöperation of the cost department, the factory manager, the foremen, the timekeepers, the stores departments, and the laborers themselves.

As the chief value lies in the use that is made of a cost system, its utility will in turn depend upon the form and character of the reports that are built up from it. Executive reports that are mere transcripts of the cost figures, while better than nothing, do not offer a proper basis for constructive action. The cost department is interested primarily in securing the accounting record on product costs, and altho these records should be analytical and indicate the direction and nature of production facts, the cost clerks may not be able or may not have the time to interpret these facts for managerial purposes. It then becomes the duty of the chief cost accountant or the comptroller in charge of all accounting to properly analyze and inter-

pret the cost figures as they express production facts, and to submit his analysis and interpretation to the chief executive.

1. Nature of Reports

These reports to executives should be more than a series of accounting exhibits. If the results shown by the exhibits can be outlined in letter form and their effect upon business and manufacturing policies described in the form of a brief, the exhibits will become fundamental facts rather than forbidding complexities. The preparation of a proper monthly accounting report requires the highest type of analytical mind. We cannot emphasize too strongly the need of employing broad-minded, capable, and forward-looking men in the important positions of comptroller and chief cost accountant. These positions demand men versed in advanced general accounting, cost accounting, industrial engineering, mechanics, factory organization, labor and production problems, management, finance, personnel arrangements, political economy, and last but not least, men who know how to write and speak effectively. Given all these qualities, combined with tact and agreeable personality, one should be able to expect reports which an executive would delight in reading, and which would be of inestimable aid in shaping executive policies.

Graphs and charts should be used whenever possible as they in many instances carry their messages more clearly than any other method of presentation.

If a report is intended for a man of very practical turn of mind, percentages and comparative statistics will appeal quite strongly. The accountant should first

study the man to whom he reports so that he may determine what form of report will make the proper impression. If this is done, indifference on the part of the executive may often be converted into interest and an understanding of the valuable work which a properly organized cost department can perform.

What a Cost Report Contains. A cost report should contain the following information and should be so presented that executive action will be taken wherever needed:

A general summary of the costs of all production whether completed or in process. This summary must show the total material, labor, and factory overhead charged against production, and the entire scheduled factory overhead even if not all absorbed. If the factory overhead has not been absorbed, the reasons should be clearly revealed by showing up the department or departments contributing to the deficiency. The general summary may be expressed as in Figure 54.

Comparison of Summaries and Results. A comparison of the preceding summaries should be made with the results obtained in the corresponding month of the previous year, with the preceding month, and with the cumulative figures of the current period. This is especially true if the business is a seasonal one. Such a general comparison will clearly indicate certain tendencies. For example: the comparison with cumulative results of the months of the period preceding the current month will at once show the tendency with relation to factory overhead absorption, the ability of the department foremen to reduce unabsorbed burden, the relation of production volume (in values) to

SUMMARY OF COSTS OF PRODUCTION
MONTH OF MARCH 19

	Material		Direct Labor		Factory Overhead		Total	
	Cost	Per cent of Total	Cost	Per cent of Total	Cost	Per cent of Total	Cost	Per cent of Total
Production Cost:								
Finished	$20,000.00	22.222	$30,000.00	33.333	$40,000.00	44.445	$ 90,000.00	100.000
In Process	5,000.00	37.040	4,000.00	29.630	4,500.00	33.330	13,500.00	100.000
Total	$25,000.00	24.155	$34,000.00	32.850	$44,500.00	42.995	$103,500.00	100.000
Unabsorbed Factory Overhead . . .					500.00		500.00	
Total Factory Costs	$25,000.00		$34,000.00		$45,000.00		$104,000.00	

Analysis of Unabsorbed Factory Overhead:		
Department 1	$300.00	
Department 2	150.00	
Department 3	50.00	$500.00
Percentage Analysis of Costs:		
Percentages of Factory Overhead to Direct Labor:		
Finished Goods		133.33%
In Process		112.50%
All Production		130.88%
Percentage of Unabsorbed Factory Overhead to Scheduled Factory Overhead		1.124%
Percentage of Unabsorbed Factory Overhead to Total Direct Labor		1.471%

FIGURE 54

factory overhead, of direct labor to overhead and the relationship of direct labor to total costs. An inspection of unabsorbed factory overhead in its relation to total factory costs may also be illuminating. If the scheduled overhead, which is based largely upon certain fixed charges, is the same for corresponding months in two consecutive years, and the unabsorbed portion happens to be approximately the same, yet it is found that the total costs have changed, some very sound conclusions may be drawn. If the total costs have increased, without any real increase in factory overhead, it is apparent that labor or material or both are costing more. Whether this is an advantage or a disadvantage will depend upon the changes in the volume of production. In other words if an examination into quantities produced during each of the two periods must be made, it may be found that the increased labor and material costs will show a smaller per unit cost of production than previously. Such comparisons of totals indicate their lack of conclusiveness and establish the need for a more detailed analysis which will automatically answer the questions that are presented by comparison of totals only. But if the comparison of totals serves the purpose of calling attention to such questions, the presentation of reports giving total results first is entirely justified. Reports to be valuable must arouse inquisitiveness and the desire for more detailed and, generally, much needed investigaton.

2. Information in Cost Accounts

Following the general summary, and in accord with it, the details of finished products should be first presented, because as a rule no definite conclusions as to the significance of expenditures for goods in process

can be drawn. The report shown in Figure 55 is one type of detailed report on finished production.

The tabulations in this report are of value because they offer the necessary general information regarding unit cost—not only the total unit costs, but the unit costs of all the elements making up the total unit costs. To be of greatest value, the various unit costs must be compared with previous costs on like production, or with an established standard unit-cost schedule. Such comparisons create unit standards; not permanent standards of the value increments of material, labor, and factory overhead, but conclusive standards of the quantities of material, the hours of labor, and the normal factory overhead necessary to effective production of definite articles.

In the table the unit costs are expressed in terms of value because that must be the first expression, and may be the only expression necessary in most cases for report purposes. Comparisons on a value basis will ordinarily bring out variations in unit costs quite plainly, and at least sufficiently to take the necessary steps to discover the causes of variation. A report to an executive which clearly offers an opportunity, by comparison with past reports of cost standards, to discover variations in cost units is a great aid to management. Under the cost system outlined adequate means to definitely trace cost variations are provided. If, for example, the comparison of unit costs reveals a variation in the labor element, cause of the variation can be readily fixed, because the master cost sheets behind the reports compared will show the department where the variations occurred. Likewise the direct labor cost sheets will show on what operation the variation took

PRODUCTION COST OF FINISHED PRODUCT—March, 19

PARTS		MATERIAL COST		DIRECT LABOR		FACTORY OVERHEAD		TOTAL COSTS	
Type	Quantity	Total	Unit	Total	Unit	Total	Unit	Total	Unit
A	100	$ 1,500.00	$ 15.00	$ 2,000.00	$ 20.00	$ 2,100.00	$ 21.00	$ 5,600.00	$56.00
B	200	1,800.00	9.00	1,500.00	7.50	1,800.00	9.00	5,100.00	25.50
C	150	1,700.00	11.33-1/3	2,500.00	16.66-2/3	3,100.00	20.66-2/3	7,300.00	48.66-2/3
Totals		$ 5,000.00		$ 6,000.00		$ 7,000.00		$18,000.00	
SUB ASSEMBLIES:									
X	50	$ 2,000.00	$ 40.00	$ 2,500.00	$ 50.00	$ 3,000.00	$ 60.00	$ 7,500.00	$150.00
Y	80	3,200.00	40.00	2,000.00	25.00	2,400.00	30.00	7,600.00	95.00
Z	70	1,400.00	20.00	700.00	10.00	1,400.00	20.00	3,500.00	50.00
		$ 6,600.00		$ 5,200.00		$ 6,800.00		$18,600.00	
FINISHED PRODUCT:									
R	20	$ 3,000.00	$150.00	$ 7,000.00	$350.00	$ 9,000.00	$450.00	$19,000.00	$950.00
S	30	4,000.00	133.33-1/3	10,000.00	333.33-1/3	12,000.00	400.00	26,000.00	866.66-2/3
T	10	1,400.00	140.00	1,800.00	180.00	5,200.00	520.00	8,400.00	840.00
		$ 8,400.00		$18,800.00		$26,200.00		$53,400.00	
Grand Total		$20,000.00		$30,000.00		$40,000.00		$90,000.00	

FIGURE 55.

place. In fact, not only the operation will be known, but the very laborer or laborers responsible for the operation.

Departmental Operations. No series of cost reports submitted to the executive department would be complete without a statement of departmental operations. The various master cost sheets indicate the departments involved in production. From these sheets, as supported by the material cost sheets, the direct labor cost sheets, and the summarized factory overhead cost sheets, it is possible to draw up departmental cost summaries as shown in Figure 56.

	MATERIAL	DIRECT LABOR	FACTORY OVERHEAD	UNEARNED BURDEN	TOTAL
		DEPARTMENT 1			
Finished	$ 5,000.00	$ 6,000.00	$ 7,000.00	....	$ 18,000.00
In Process	2,000.00	1,500.00	2,000.00	....	5,500.00
Unearned Burden	....	....	....	$300.00	300.00
	$ 7,000.00	$ 7,500.00	$ 9,000.00	$300.00	$ 23,800.00
		DEPARTMENT 2			
Finished	$ 7,000.00	$ 8,000.00	$ 8,000.00	....	$ 23,000.00
In Process	2,000.00	2,000.00	1,800.00	....	5,800.00
Unearned Burden	....	....	....	$150.00	150.00
	$ 9,000.00	$10,000.00	$ 9,800.00	$150.00	$ 28,950.00
		DEPARTMENT 3			
Finished	$ 8,000.00	$16,000.00	$25,000.00	....	$49,000.00
In Process	1,000.00	500.00	700.00	....	2,200.00
Unearned Burden	....	....	....	$ 50.00	50.00
	$ 9,000.00	$16,500.00	$25,700.00	$ 50.00	$ 51,250.00
Totals	$25,000.00	$34,000.00	$44,500.00	$500.00	$104,000.00

FIGURE 56.

The amounts of materials withdrawn for departmental operations is not indicative of anything in particular, because variations may exist at all times in the relationship between materials going into finished products and materials used on orders in process. As a rule, if material values do not change appreciably, the total value of materials put into production will indicate whether or not the departments are working at or near capacity. Probably the most important feature of the departmental statement is the factory overhead and the relationship of factory overhead to the values of finished and in process production. In order to establish a proper relationship, reference by departments must be had to the production orders finished and in process, so that a percentage of overhead to total costs on each type of product going thru a department may be established. This ratio on the finished product of each class should be about the same from month to month. On goods in process the ratio will naturally vary in accordance with the progress reached at any given time. But such ratios on work in progress will show what the overhead should be at each stage of progress, information which may be of great value in judging the efficiency of production in these various stages of progress. Shortcomings can then be more or less localized and possibly eliminated entirely. To amply support and give proper value to a departmental statement implies the preparation of the necessary subsidiary schedules in order to establish properly the facts and relationships just discussed.

Unearned Burden. Another important feature of a departmental statement is the amount of unearned burden chargeable against the various departments.

From this information, investigations as to the causes of the unearned burden should be made. The existence of an Unearned Burden Account means that something irregular has occurred. Was the irregularity due to department foremen's inefficiency, to slack business, to a breakdown, to lack of material, or to some other agency? These questions should form the basis for an analysis of unearned burden and should regulate the expression of that analysis. Unearned burden cannot be eliminated, except under ideal conditions, but an analysis of the item will at least disclose what is avoidable. Analysis will often fix the responsibility for the unearned burden, and in every case reveal its cause.

3. Unearned Burden and Machine Arrangement

The Unearned Burden Account, as studied in relation to individual machines or groups of machines, will disclose what the proper proportioning of machines to processes in sequence should be. In connection with a departmental statement of unearned burden, a supplement indicating the composition of the unearned burden should be furnished; this supplement should show the machines or equipment involved in the creation of the unearned burden, and should show the processes or operations of each machine or production center. If this supplemental statement is then compared with the routing sheets which show the sequential processes thru which production travels, they will probably furnish valuable information as to productive equipment in the various process centers. Given a certain physical space capacity, and assuming a proper space distribution for departments and processes, it is entirely possible to arrange the investment in machines and productive equipment so that neither

too many nor too few machines will be provided for each process. The result will be a proper proportioning of equipment. Under ideal conditions this would mean the entire elimination of unearned burden. If these ideal conditions cannot be attained because of slack business and factory internal shortcomings, an effort should be made to at least approximate them.

Special Machines. Special service machines which from the very nature of things can only operate on a part-time schedule, cannot be considered in the same light as the regular equipment. A machine, exactly as a given quota of stores, should yield a maximum investment turnover which, for the machine, should be expressed in hours of productive operation. It is obvious that a study of machinery in its relation to productive processes will enable the management to carry the minimum investment necessary to obtain maximum results. Such an analysis will also show the advantage of engaging in standardized production—adhering as closely as possible to certain fixed lines of product. The manufacturer who constantly changes from one product to another has generally to face the quite serious problem of heavy investments in new machinery and tools, and the consequent scrapping of the older equipment, even tho the latter may be thoroly serviceable.

Maximum Profits thru Knowledge. The author has always believed that industrial success or, in fact, success in any field depends upon exact knowledge of the conditions prevailing within that field. The expression may be trite, but "knowledge is power." In that expression lies the very kernel of success, and yet it is

something quite difficult to convince an executive that he cannot succeed without this exact knowledge. Just as "knowledge is power" so "a little knowledge is a dangerous thing." The trouble and danger is that those possessed of "a little knowledge" too often believe themselves endowed with all the knowledge necessary. The average executive is satisfied if his business shows a profit and generally gives little thought to whether or not that profit represents the maximum profit of which the business is capable. Not until he makes the maximum profit may he consider himself a real executive.

It is the mission of the cost accountant, chief accountant, or comptroller to furnish the information which will supply the management with the knowledge that will make maximum results possible. Only when accountants furnish such knowledge can they be said to be serving industry effectively. As soon as this happens they will as a class receive the recognition which many of them feel has been unjustly withheld. The accountant who can show how profits are made, where losses occur, how leaks arise, and how they may be eliminated, how economies may be effected and production increased, how operations may be standardized, and efficiency introduced, will certainly find an enviable position in the top ranks of industry. He can do all these things if his system of accounts is truly analytical, and if his reports dig down deep into the fundamentals of factory and business operations.

4. The Relation of the Cost Department to Other Departments

If the cost department functions promptly and cooperates fully with several other departments of a

manufacturing business, it can become a very vital factor in the success of the entire plant. Statements must be submitted promptly. There should be more publicity of costs, and the cost department should see that the foremen especially make use of cost reports.

The cost department should furnish the sales department with the lists of the parts, subassemblies, and finished products with the costs. Such information is necessary, in conjunction with general policies, so that proper sales policies may be established. The superintendent or works manager is interested in all costs, and particularly in direct labor statistics, factory expenses, and machine burdens and repairs. The purchasing department should have reports on slow-moving stock, and on the condition of the maximum and minimum quantities of stock. While a great deal of this information can be gotten from various tabulated sources, and a great deal of it will appear in the cost department, some agency should actually produce the information thru the medium of definite reports to the departments interested. In our opinion, the cost department is the logical agency for the dissemination of this information.

No other department in an organization has the possibilities for effecting coördination and instituting changes to improve methods as does the cost department. It has the information relating to the expense and efficiency of every operating department. It has the data concerning the efficiency or inefficiency of men, foremen, and even superintendents.

The cost department may be an important factor in guiding the chief executive in his far reaching policies. He requires from the cost department periodical infor-

mation concerning the costs of materials, labor, and overhead of every important manufacturing operation. In analyzing cost results, the chief executive will want to know what changes are required in the cost system to give him the details that he requires. He wants to know where executive action is necessary to correct inefficiencies resulting from unbalanced operating departments and losses thru defective work. He wants to know thru cost information what policies he should consider in connection with the sales department.

The cost department must render its reports promptly if the chief executive is to use them in formulating policies respecting the business. The reports should be fully explained and attention directed to any points of interest. If the cost department is to reach its maximum of usefulness full coördination and coöperation must exist thruout the organization.

Chapter XIX

THE OPERATION OF A COST DEPARTMENT

Just as the general ledger expresses the total controlling figures for all costs, there must also be a general control over the actual work of cost accounting. It has been found expedient and necessary to center the responsibility for all accounting on the general auditor or comptroller who will have authority over the chief cost accountant and the chief general accountant. The chart shown in Figure 57 will illustrate the organization of an accounting department.

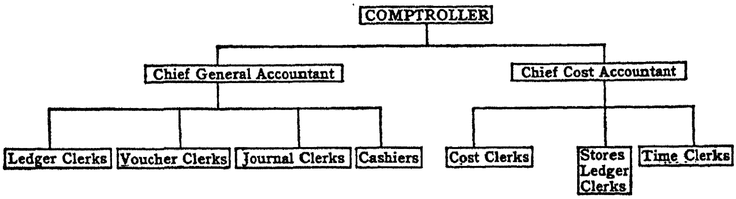

FIGURE 57.

In this scheme of organization, equal powers and responsibilities are given to the chief general accountant and the chief cost accountant. The chief general accountant should keep the general ledger, make all general journal entries, and supervise the keeping of the voucher registers, sales journals, cash books, accounts receivable and payable ledgers, and all subsidiary records which are kept in the general accounting office.

The chief cost accountant should be held responsible for the actual operation of the cost system. He must be familiar with mechanical operations and processes

in addition to having a thoro knowledge of the principles of cost and general accounting. He should not be merely a tabulator of statistics, recording the various cost figures, but he must be able to analyze and interpret these figures so that he can at any time present an intelligent survey of factory operations to the comptroller. This will enable the comptroller in turn to submit the proper reports for managerial attention.

Specialization of Cost Clerks. It is desirable that the chief cost accountant provide a proper division of labor for the cost clerks, so that each group of clerks may become expert in handling certain divisions of cost accounting. Certain clerks confine their efforts to the tabulation of material costs, others occupy themselves with direct labor costs, and still others with factory overhead and machine-hour burden application. In time, such subdivision of functions will develop a knowledge of details which will make each clerical group quite expert in the problems peculiar to it. Such specialization is bound to develop a real analytical attitude towards the cost data handled by each group. In order to prepare some of the more promising men for greater responsibilities, they should be shifted from time to time from one group to another.

The chief cost accountant should be in charge of both stores ledger clerks and time clerks. The duties of both these groups are essentially of a cost accounting nature. Without proper stores records, it is quite impossible to formulate correct material costs, and unless timekeeping is absolutely accurate and reliable, no adequate record of labor costs can be obtained. The development of specialization among the cost clerks

will provide a very excellent check on the work of the stores ledger clerks and the timekeepers. The cost clerks, thru their special knowledge of either material costs or direct labor costs, could very readily detect variations in these respective costs as reported or tabulated by the stores ledger clerks and timekeepers.

Further Specialization. Specialization should exist for the stores ledger clerks and the timekeepers, as well as for the cost clerks. The stores ledger clerks should be placed in charge of ledgers which control certain classes of stores only (if such subdivision can be made), thus becoming thoroly familiar with both the prices and requirements of these particular stores. This will make coöperation with the cost clerks specializing on material costs quite easy, and quickly settle any disputes arising in material cost tabulations. If timekeepers are assigned to definite sections in the factory, they will soon understand every detail of labor and every machine operation as well as the habits of the workers themselves. The timekeeper, if at all observant, can very easily make himself valuable to the department foreman in the latter's efforts to standardize labor time on operations. He can also be of material assistance to the cost clerks specializing on labor costs.

Distributing Overhead. The distribution of factory overhead or burden requires a considerable knowledge of all the elements involved in computing the machine-hour rate, and it is imperative that the chief cost accountant give a great deal of attention to this phase of cost accounting. The reconciliation of burden applied in the cost department, with the entries recording

burden application in the general ledger, is considerably more involved than the "tie-up" between materials and labor charged in the cost records and the entries recording these same costs in the general books.

It falls upon the chief cost accountant, in coöperation with the chief general accountant, to reconcile the general books with the cost department's records. It is for this reason we have always believed that the chief cost accountant must be well versed in general accounting, and vice versa that the chief general accountant have a very complete knowledge of cost accounting. The comptroller at the head of the entire accounting organization must, of course, be an expert in both fields of accounting, besides possessing the other necessary qualifications.

Coöperation Essential. The efficacy of operation of any cost department is dependent upon the proper coöperation accorded by the general management, the factory management, the foremen, and the laborers themselves. If the management views a cost system as merely a necessary evil to be curtailed as far as possible, no beneficial results may be expected, and the cost records will be mere history only; but if viewed as a source of information for executive guidance and so supported that the very best analytical results may be obtained, the cost system will become the central point around which all managerial effort in a plant radiates. In that case it will demonstrate itself as an investment paying big dividends.

The fact that many executives have not realized the value of cost systems is due, in a certain degree, to the

inadequacy of many so-called "cost systems"—systems which do not fit the business or which are meaningless. The reliable, worthwhile cost accountant is often classed by the executive with the charlatan who has, thru judicious advertising or solicitation, induced the executive to accept a system wholly inadequate for his needs. It is to be hoped that the better cost-accounting organizations, such as the National Association of Cost Accountants, will expend some effort in educating the business world to an appreciation of the difference between real and "would-be" cost accounting systems and cost accountants.

Making a Cost System Effective. In order to make a cost system effective, it is always necessary to secure the full coöperation of the factory management and the foremen, especially the latter. If a foreman can be shown that a cost system is a real aid in the administration of his department, and that his remuneration will be based upon the improvements he is able to inject into his work because of the wider knowledge given him thru the cost system, there is every reason to believe that his coöperation will be forthcoming. If the ideal of accomplishment and pride in results is held up to a foreman, a real stimulus has been created. A cost system can never be successful if forced in; it must appear as a plan by which each individual can make himself more valuable to the company. In order to gain the coöperation of foremen, they must be made integral parts of the cost system; they must be made to feel that their coöperation is valuable, and that they can contribute materially to the success of the industry as a whole. Nothing can be accomplished if the fore-

man is regarded as merely one to obediently follow orders, many of them not intelligently given.

The worker can also be appealed to thru the proper spirit of coöperation. No one cares to be pointed out as inefficient and if the ideal of accomplishment and the joy of doing can be injected into the labor force, any plan of determining costs which will show up the possibilities for improvement will be welcomed, especially if the greater effort demanded is justly rewarded.

Factory Committees. The effective operation of a cost system can be greatly facilitated thru the creation of various factory committees in which not only the members of the cost department will participate, but which may include at certain times group representatives of the factory workers, the foremen, and members of the production department. It is not necessary that such committees meet more than once a month, or better still, only at such times when a meeting is really needed. It is not necessary to endow such committees with any executive power; their work should be merely advisory, thus permitting all orders to come thru in the usual manner.

Cost-Reduction Committee. A committee designated as a "factory cost committee" composed of the comptroller as chairman, the chief cost accountant, the factory manager, and the foremen would form a quite logical unit for the discussion of problems relating to cost reduction, stores requirements, machine arrangements, and cost or production standards. At times a representative of some labor group might also serve, especially if the discussion concerned itself with definite labor operations. A committee of this kind

with no power to act, but with the power to recommend, should be of considerable assistance in expediting the operation of the cost system and in raising the standard of factory management. All recommendations made by this committee should be conveyed to the general manager for his approval.

Chief Cost Accountant's Function. The function of the chief cost accountant is not merely to account for and record cost facts, but to interpret this data for executive action. Much of the responsibility falls upon the cost accountant to make cost accounting the instrument of service it should be to the business man.

If the management has not been getting the most possible value out of his cost system, no doubt the fault is in the cost accountant. The cost accountant may well place a mirror before himself and insist upon answers to these questions:

1. Have I made my cost reports simple and concise, touching the principal and salient points of information?
2. Do I interpret the cost results or leave it to the executive to draw his own conclusions?
3. Do I use graphic charts and percentages to exhibit the cost results?
4. Do I afford ready comparisons with past and standard performances?
5. Do I keep my cost figures locked up tight within my own department?
6. Do I make useless reports?
7. Do I give my cost reports wide publicity, so that the management, department heads, foremen and even the workmen may see the cost figures that particularly concern them?

8. Have I initiated a program of organizing cost conferences to present and discuss cost results?
9. Have I given to management all that it is possible to draw out of the cost analyses?

It is undoubtedly true that business men are not even approximately receiving the service that they have the right to expect. The executive should expect assistance from his cost accountant, covering a wide field of activity, not in the mere provision of figures, but in bringing before him the special points which appear to demand attention. The works manager can receive help on many points arising in the management of the factory, if the cost accountant presents the cost results in report form and calls attention to the special features.

There is perhaps no greater service the cost accountant can perform for the general manager than to help him formulate a budget which will yield a reasonable profit on a normal year's business. The cost accountant may bring cost figures to support the high cost, as well as the uselessness of manufacturing anything that does not yield a reasonable profit.

If the cost accountant is successful in establishing standards of material consumption, standards of labor performance, standards of factory overhead, standards of auxiliary service, all of which may be compared with actual results, the executive may have a fair index of the efficiency of his factory.

There is, without doubt, a large field of usefulness ahead of cost accountants in increasing the effectiveness of cost systems.

Chapter XX

UNIFORM COST ACCOUNTING SYSTEMS

Within recent years a great many trade and manufacturing associations have inaugurated uniform cost accounting systems, hoping to put all their members beyond the dangers of ignorant competition. As a rule, such systems are desirable, altho to make them really successful implies more than a mere uniformity. Not only must the systems be uniform, but they must be based upon sound cost accounting principles. This does not mean that each member of an association must have a system identical with all the others, but that the general procedure must be uniform. It might have been better to have called these systems "unified" rather than "uniform."

The object of these so-called "uniform" cost accounting systems is not to stifle competition, but to make it more intelligent. If every member of an association knows his costs, one may rest assured that prices will be sufficient to return the costs and generally a fair profit and so-called "cut-throat" competition will at the same time be largely eliminated. These associations are not formed for "price-fixing" purposes and are not in "restraint of trade."

National economy can best be served by intelligent sales pricing. The self-interest of the members and the disposition of the buying public act as safeguards against unfair prices. The low-cost producer will still have the advantage, and his lower prices will simply afford a beneficent inducement for his competitor to

introduce all possible economies and efficiencies so that he too may become a low-cost producer.

Operating a Uniform Cost System. The operation of a uniform cost accounting system does not require subscribers to disclose their business secrets to each other. Sales prices need not be uncovered, nor is it necessary that definite cost figures be divulged. It is essential, if all the members of an association are to be benefited, that some uniform method of expressing cost results be established and the same cost elements presented for comparison. When the question of factory overhead is considered, it is essential that all members of an association include the same cost elements therein.

In some associations the members have not hesitated in presenting their entire cost results, feeling that the greatest good can only come thru complete interchange of cost information. Wherever this plan exists the poorly organized member may be considerably aided, for he can readily see how and where he can improve in his own operations. If a comparison of unit costs can be made so that the unit costs of material, labor, and the various elements of factory overhead are clearly expressed, the reasons for variations will be readily apparent. Some of these variations may express conditions which cannot be altered, but others may be entirely due to operating conditions.

Differences will naturally exist in depreciation rates and power charges, depending upon the plant structures and the power departments. But even such differences as these may eventually establish a knowledge of the most advantageous plant and power structures,

the best machines for manufacture, and the most desirable departmentalization. Among the conditions which may be immediately affected thru cost comparisons are machine arrangements, the use of mechanical auxiliaries, routing of product thru the plant, the use of special tools, dies and jigs, the control of indirect labor, and the relationship between factory costs and so-called "commercial overhead."

Percentage Comparisons. Where it is deemed unwise or inexpedient in associations to furnish complete detailed information regarding relative costs, much good can be accomplished if the cost results are expressed in terms of percentages to some common base, preferably not sales. Sales price is generally a variable because of certain differences in design or bulk of product. It may be that the relationship of the various cost elements to total cost is the best basis for comparison. Taking the total cost at 100 per cent, it would be instructive to know the general subdivisions of this 100 per cent into material cost, direct labor cost, and factory overhead. Variations brought out by these general comparisons might then be further detailed so that the elements creating the variations could be known and the reasons determined. In all these matters it is essential that the elements compared be identical.

Limitations of Uniform Systems. Uniform cost accounting systems are limited in the results they bring about by the ability of those who install and operate them. Unless they are installed by competent cost experts, they are apt to have decided limitations, and the knowledge of cost accounting gained from them

may be very erroneous. Often when such systems are installed by the members of an association, the cost system of some one member is universally applied. If this one system is weak, then the entire structure is faulty, because individual variations have not been taken into consideration. Very often some enterprising pseudo cost accountant employed by an association member imagines that he has "seen the light," and solely thru a misguided enthusiasm induces the adoption of his cost system by the association. Naturally, in such a case the value of the system is dependent entirely upon the particular cost accountant's grasp of cost essentials. For this reason, uniform cost accounting systems may present a mixture of cost interpretations. Some may be based upon perfectly sound principles, while others may be positively undesirable.

In the last analysis the best feature of a uniform cost accounting system is the uniform expression of cost results making valuable comparisons possible. In the individual application of such systems, each plant must adopt variations to meet its own peculiarities. It is a great step in the right direction to have a cost system, and associations which have adopted uniform systems have at least given their members, or some of them, a cost system which is certainly far better than no system at all.

Cost Organizations. In October, 1919, the National Association of Cost Accountants was formed. The objects of this organization are to promote a wider interest in the study and application of cost accounting, to create a cordial understanding among all persons interested in cost accounting, and to standard-

ize cost accounting practice, theory, and terminology. The growth of this organization has been rather phenomenal, a fact indicating the constantly growing interest in cost accounting. A national clearing house of this character, embracing in its membership all types of industry, cost accountants in public practice, and many prominent Certified Public Accountants, will stimulate American industry to a fuller comprehension of the vital importance and necessity of proper and adequate cost accounting methods.

The more specific objects of the organization as set forth in the Constitution and the records of the governing bodies may be stated as follows:

1. To promote more intimate acquaintance and better understanding among cost men of all classes.
2. To collect, organize and distribute among the members useful information dealing with all phases of cost work.
3. To develop, improve, and so far as practicable standardize the science and art of cost accounting.
4. To promote the study of cost accounting along scientific lines, thru coöperation with recognized institutions, and by means of publications issued under the auspices of the association.
5. To encourage young men who are preparing to take up cost accounting as a life work. To give them an opportunity to become acquainted with men of practical experience, and to assist them in their studies by the distribution of sound information. A special class of membership, juniors, has been created to provide for those who are not able to meet the requirements for membership in the more advanced classes.
6. To protect the best interests of all members of the association by the establishment and maintenance of

high moral standards within the association, and by aiding in the suppression of all practices which may tend to prejudice the good reputation of the profession of cost accounting.

Chapter XXI

SPECIAL COST CONSIDERATIONS

Separate orders must be used in arriving at the cost of repairs and construction work. Both repairs and construction should be handled on a job basis unless the work is done under an outside contract. If distinct repair and construction laborers are employed in a plant, it is generally feasible to create a repair and construction department with a capable foreman in charge of the work. But, whether a separate department exists, or the work is performed from time to time by the regular indirect-labor force, the same control looking towards an effective performance must exist, so that all jobs may be completed at a minimum cost.

In many large plants distinct repair and construction departments exist. The department may then be viewed as a separate plant and should operate its own storeroom. Whenever circumstances warrant the existence of such a department, the entire repair work should be localized within that department. Specialization along the various lines of repair work can then be established so that certain laborers will be expert in power-plant repairs, others in machinery repairs, and still others in building repairs. The entire cost of repairs will be charged against the proper factory overhead reserve account. Repairs to the power plant or any of the power facilities will be charged to the Reserve for Power Expense after the entire repair job has been completed.

Where separate repair departments exist, a separate section of the plant or separate building should be utilized, so that the overhead applicable to repair jobs will not in any way be merged or associated with the regular productive factory overhead. In smaller plants where the regular labor force or a specially hired crew perform repair work, it is considered conservative not to charge any portion of the factory overhead to the jobs, especially if the repairs are not numerous and the jobs of short duration. The same is true of construction jobs. If work in both repairs and construction is extensive, and the regular labor force is employed, some factory overhead should be allocated, especially if the work entails an abridgement in production during the period.

Repair Requisitions. The requisition for repairs should come from the department foreman and be made on the superintendent or the works manager. The requisition is then approved and transmitted to the engineering department which has direct supervision over the repair and construction department. Where no engineering department exists, the control of repairs should be vested in the superintendent. Whatever procedure is followed, a repair order should be issued to the repair department, and all costs in connection with the repair jobs will be charged to the repair order numbers. The superintendent must naturally pass upon the question of whether the need for the repair exists or not. In the case of construction orders, where the question of need is a much wider one and naturally involves the additional question of plant extension or betterment, the requisition should be approved by the general management.

Charging Repairs. As far as the general books are concerned, all expenditures for repairs and construction work should be charged to repair orders in process and construction orders in process. If a special department is maintained, the labor charges to these accounts will come from the departmental pay roll. If the repair and construction labor is performed by the regular factory force, the accounts will be charged from the distribution shown on the regular factory pay roll. Charges against the accounts for materials used will come from the requisitions made against repair and construction stores, or possibly in some instances directly from purchases made and entered in the voucher register.

The cost accounting for repair and construction jobs closely resembles the accounting for regular production orders. The requisitions on stores will furnish the information for a properly distributed material cost. The laborers' daily time reports will yield the information for recording the analysis of the labor cost. The overhead, if there is any, will be charged against each job on an equitable basis. At the end of any month there will be orders that have been finished during the month and orders that are still in process. The latter will be continued in the cost files until finished, and the orders finished during the month will be tabulated for the necessary journal entry which will be expressed as follows:

Fixed Assets (Buildings, Machinery, or Equipment)	$......	
Factory Expense.	......	
To Repair Orders in Process . . .		$......
Construction Orders in Process . .		......

(Explanation: To record cost of Construction and Repair Orders completed during the month of

..............19— and to charge the proper Asset and Factory Expense accounts.)

In view of the fact that repairs to buildings, machinery, and equipment become a part of factory cost or of product cost, it is of great importance to secure analytical data on repair costs. Repair operations should be standardized as fully as possible so that a period experience will furnish a sound basis for factory overhead computation for the succeeding period or periods. A detailed statement of repair costs will also be of value in pointing out the location of weaknesses in the plant, and may lead to the elimination of those types of equipment requiring more than ordinary repairs. It is also necessary to know the chief factors that make repairs necessary. This should be determined as closely as possible when the repair order is called for, but it may be that the real factors of weakness will be more apparent thru a proper cost analysis on the repair order. For this reason the repair-order cost accounting should be fully analytical.

Defective Work. Defective work arises, either out of poor workmanship or because of defective material. It is not an item which can legitimately be charged against a production order, and is to a certain extent a part of general factory overhead. This refers particularly to an ordinary quota of defective work which cannot be eliminated no matter how close the inspection.

Defective work, resulting from poor material, can be charged back to the vendor, at least to the extent of the value of the material, but defective work resulting from poor workmanship or inadequate inspection

cannot be charged directly to the order in process. Whenever the defect is discovered, a credit must be made on the order for all the labor, material, and overhead involved, and the amount of such expenditures must be charged to a defective work account or to some overhead reserve account if provision has been made for the absorption of these expenditures thru general factory overhead. If the defect arising out of poor workmanship can be remedied, the additional expense should be charged to the Defective Work Account, the remainder of the charges applying to the production order.

In reporting defective work, full information as to the character of and responsibility for the defect or error should be made, and the proper forms utilized. These forms should yield the following information:

Date	Order number
Part number	Number of pieces defective
Material defective	Workmanship defective
Operation defective	Operator responsible
Department	Machine number

Defects or errors explained in detail
Total cost of work to date

1. Material
2. Labor
3. Overhead
4. Total

Work to be entirely rejected and scrapped
Additional work necessary to restore
Cost of such additional work
Errors due to defective drawings
Defect due to poor material
Amount chargeable to vendor
Amount chargeable to defective work account

Final disposition
Is material to be replaced or order to be finished short?
Name of inspector

It may not be necessary to have all this information in every case, but the items suggested will probably meet most conditions, and a selected assortment might suffice in particular cases.

The whole problem of defective work is intimately associated with the function of inspection. The extent and nature of errors and defects in manufacturing will depend largely upon how efficient the inspection is. Inspection should be independent of the operating departments, and the inspection department should be responsible directly to the works manager. Inspection influenced by the superintendent or foreman is apt to cover up rather than disclose. The inspection should not be under the control of the engineering department, because many errors arise directly from improper drawings and designs.

To be adequate, inspection must exist all along the line. There must be inspection of incoming materials, castings, and parts, work in process, and the finished product, all supported by whatever tests any particular line of production may require. This inspection in some plants must be very exacting; in others it may be quite simple. In some plants dimensional inspection is necessary after each operation, while in certain assembly plants where all parts are purchased on definite specifications, an inspection of incoming materials, parts, and of the final product is generally sufficient. Much defective work due to poor materials received from vendors may be avoided thru buying on an exact specification basis. Defective work cannot

be reduced without such precautions or without proper inspection and reports as to the causes or responsibility for errors and defects.

Finished Stock Records. Finished parts, subassembly, and finished product inventories have been discussed and the controlling accounts that appear in the general ledger designated. It will be remembered that when parts production orders were finished, the account, Production Orders in Process was credited, and Finished Parts Inventory charged. In the same manner, Production Orders in Process was credited and Subassembly Inventory and Finished Product Inventory were charged. These charges were made when the subassembly and final assembly orders were completed. We have three inventories in addition to the raw materials inventory:

Finished parts
Subassemblies
Finished product

All these inventories may, in a sense, be considered as finished stock, because sales may be made from any or all of them. All finished stock may or may not be fabricated in the factory—some may be purchased from the outside. Inventory records and stores control, in every way as adequate as that provided for raw materials, must be in force. The charges to the stores ledgers for finished stock will come, either in part from the finished orders and purchase invoices or in full from either of these sources. The credits to the individual stores or stock accounts will be made, either from requisitions for further factory assembly, or because of sales, or they may present a combination

of the two. It is imperative that the stores records for finished stock be just as carefully handled as the raw material stores ledgers.

In crediting finished parts ledgers for parts used in either subassembly or final assembly, the credit should indicate the subassembly or final assembly order number. In crediting subassembly ledgers, the final assembly order number should be shown. When sales are made from any of these stocks, the sales invoice number should be recorded in the Stock Ledger Account, so that the sales register may be balanced with the stock ledgers as to quantities, and with the proper Cost of Sales Account as to costs. It is also advisable to furnish the sales department with complete lists of all the parts, subassemblies, and finished products, in order that the stock offered for sale may be properly priced to customers. Whether or not the sales department should have the actual total costs of the products is a question of policy. Some manufacturers refuse to submit actual costs to their sales departments, and insist upon the addition of a certain percentage to the cost figures, fearing that the sales department may quote too low or that it may neglect to consider adequately the expenses of management or so-called "commercial overhead."

Before finished parts or products are accepted by the storekeepers, they should insist upon a complete inspection report from the inspection department. At the same time they should exercise the same care with regard to requisitions that is found in the raw material storerooms. Nothing should be withdrawn, except on requisition, for assembly orders or sales. Requisitions may not come directly from the sales department,

but thru it from the shipping department. The finished stock departments will be more or less closely associated with the shipping department, and whatever requisitions are made by it must agree with the sales recorded by the accounting department which will obtain or utilize all the requisitions left with the finished stock departments.

Finished stock must be classified and localized as to space in order that it may be readily accessible for either shipping or use in the factory. In certain forms of line production it is possible to locate the finished parts and subassemblies immediately adjacent to that section of the line where they will be used. At the same time it may be possible to provide shipping space on the other side of the stock rooms, so that no delay or extra handling or hauling will be necessary when products are sold.

Plant Location and Plant Design. The questions of plant location and plant design are of the very greatest importance, but unfortunately they have received very little attention except from industrial engineers. The average plant is too often located and built just because someone or some group of individuals fancy a certain manufacturing industry. They have seen marvelous progress in certain lines of production and they feel that their mission is to "go and do likewise." The results are chaotic transportation problems, almost impossible labor conditions, extravagant production schedules, lack of markets, ridiculous factory overhead costs, high material costs due to excessive freight rates, and finally, failure.

A plant may, of course, because of certain peculiarities of product, be fairly successful, even tho improper-

ly located or poorly designed, but how much more successful might it be in its proper place, if correctly designed? The effect on costs of incorrect design and location is very direct, and has in many instances been expressed by utter inability to compete with more favorably endowed concerns.

Plant location should be predicated upon the following considerations:

1. Proximity to the most advantageous raw materials and quantities available.
2. The condition of the local labor market as adaptable to the special and general labor needs of the industry.
3. The fuel situation and power needs.
4. Transportation facilities.
5. The available markets for product.
6. Plant construction costs.
7. Local financing and banking facilities.
8. Possibilities for expansion.

It is not always possible to secure a completely favorable combination of all these factors, but in comparing a number of locations the most favorable average should be the determining factor.

Of equal or possibly of greater importance than plant location, is plant design. In designing a plant, consideration must be given to the following factors, all of which vitally affect manufacturing costs:

1. Type of construction.
2. Materials to be used for construction.
3. The number and juxtaposition of departments so as to secure the most effective specialization without unnecessary duplication of machines and equipment, and in order to obtain the most logical sequence of operations and processes.

4. The location of storerooms to meet all demands for materials required at the various stages of production.
5. The position of the power plant so as to insure the greatest economy in the transmission of power.
6. The erection of unloading and loading platforms so as to most adequately serve the storerooms and shipping department.
7. The injection of mechanical devices as part of plant equipment in order to eliminate manhandling of heavy commodities, thereby reducing indirect labor to a minimum.
8. Adequate floor space for equipment, not only to allow freedom of movement, but in order to provide space for temporary storage of materials moving from process to process, and to make trucking or other forms of conveyance possible and easy.
9. Arrangement of machines and all other equipment within a department so as to secure proper routing of goods in the best sequential manner.
10. Proper proportioning of machines in order to obtain the maximum operating time from each machine or of group of machines, thus insuring the minimum investment necessary to secure maximum results.
11. The location of special service machines and equipment.
12. Proper systems of ventilation, sanitation, heating, lighting, fire prevention, water supply, and physical welfare.

In order to properly design a plant, it is necessary to tabulate the processes thru which the product passes, the sequence of these processes for each product, and the types of machines and equipment best suited to secure the best results. With this information at hand, a routing sheet can be prepared for each product, so that as far as possible each process in the sequence will fix the location of the machines. The

result will be the elimination of waste motion, at least as far as the major portion of the products is concerned. The manufacture of a great variety of products in one department is undesirable and expensive. As far as possible, production should be specialized so that machines and workers may be utilized on one product, or at least on similar products. Such specialization is a very large factor in cost reduction.

It is the hope of the author that the day is not far distant when manufacturers will intrust the problems of plant location to industrial engineers and practical economists, and that there will soon be model plants for each line of manufacturing industry—plants that will incorporate every possible element necessary for straight-line production. Manufacturers' associations might do well by making thoroly exhaustive studies of these all important cost reduction problems.

By-Product Costs. In speaking of by-products, it is quite necessary to make a clear distinction between what should be regarded as scrap, waste, spoilage, and defective work, and such materials created or produced as an incident of regular, orderly production for which a definite market exists or may be found. If a market exists for such incidental production, the commodities or materials produced cannot be regarded as waste, and moreover, by-products do not result from spoilage or defective work. By-products are "excreta" arising from various processes of production normally conducted, and they are not related to production errors. All by-products in a way might be called "scrap" because scrap comes nearer to being a by-product than any other residue from production.

However, scrap cannot be regarded as a definable commodity, since no specific market exists for it. Any money obtained for scrap must be regarded as merely salvage. But the revenue from by-products represents something to be sought; in fact, something for which actual sales efforts will be expended—definitely established marketable commodities.

By-products may either be a direct separation from the main product, or they may represent waste materials assembled or treated in such a way as to form a new product. It must not be assumed, however, that by-products are merely accidental. In fact, in some cases there is a greater desire for by-products than main products, and often the main production is fostered in order to secure the by-products. As suggested, by-products are sold, either in their original form or as modified products—products that need to be worked upon or treated in order to make them salable.

The revenue from by-products was at first considered as all profit, and no costs were charged against them unless they had to be refashioned. Manufacturers are now beginning to realize that costs must be distributed between main and by-products, especially if the latter are of any considerable magnitude. There is naturally no difficulty in applying costs after the by-product is once separated from the main product. But how much of the costs should be loaded on the by-product during the processes when it is still part and parcel of the one main product?

Various methods may be employed to establish the cost of by-products at the point of separation from the main product.

1. In some cases where there is no appreciable variation in the values of both products, as related to their weights, the total costs up to point of separation may be divided on a weight basis. This application will be rare.

2. Where there are no appreciable fluctuations in the market-price relationships between the main product and the by-product, the total costs may be divided upon the basis of relative market prices. This method cannot be advocated, unless there are distinct market prices, and unless the ratio of market prices of main product to by-product is practically fixed. If the market price of by-products would go up without a corresponding proportional rise in the market price of main products, the main products would not be burdened with enough cost. Unusual demands for certain by-products or main products might disturb the ratio very materially. Where the ratio between the market prices of the main and the by-products does not remain fixed, a weighted method might be used so as to retain a predetermined ratio, or a ratio which would represent the average ratio of a normal market.

By-product costs, at the best, must be an approximation, and every industry creating by-products must consider its own peculiarities in establishing costs. If a common yardstick can be found for both main and by-products, such as tons, pounds, gallons, or even heat or chemical units, a distribution on the basis of such a yardstick will be the most accurate. Otherwise, relative market prices or arbitrary subdivisions alone remain, and these have their disadvantages.

Tool Control. The importance of keeping tools in prime condition and under lock and key has been pointed out. We have also spoken of the use of tool production orders where the manufacturer makes his own tools. Our discussion applied to both hand and machine tools.

Where tools are manufactured in the plant, a special tool department should exist, and a general tool inventory account should reflect the entire production costs of the tools made. As the tools are distributed to the various tool rooms, these rooms, or the departments housing the tools, should be charged and the general tool inventory credited. Stock records should be kept for all tools in the department tool rooms, and the tools should be kept in special places, racks, or hangers, each tool or space properly marked by the tool symbol or name.

When the tool is requisitioned, the requisition itself, or a copy of it may be put in the place of the tool so that missing tools can at once be traced. As tools are returned for reconditioning, a tool repair order must be made on the tool department, the tool department to be charged with the tool that is out. All tools returned to the tool room must be thoroly inspected as to their condition, and any injuries due to carelessness reported to the department foreman. No tools should ever be given out without properly authorized requisitions. The requisitions must indicate the tools desired, the machine numbers, the operators, the orders on which the tools are needed, and the foremen's authorizations.

Waste and Scrap Salvage. As waste and scrap ordinarily reflect the natural residue from production,

any salvage should be considered as a reduction in costs. If it is impossible or impracticable to allocate the recovery to any particular product, the entire recovery should be credited to the Scrap and Waste Sales Account. At the end of any accounting period, the entire Scrap and Waste Sales Account may be credited against the general Cost of Sales Account.

If the waste and scrap result from poor workmanship or carelessness, some report must be made. In almost any industry, normal waste and scrap can be fairly estimated, and variations in daily procedure should be "followed up." Indirectly, the amount of normal waste and scrap can be fixed or practically predetermined by knowing the yield which must normally be produced out of certain classes of material. This implies that the yield must be determined. The yield, once fairly well known, makes it necessary then to properly cost the material actually going into a product.

In some industries, material prices are predetermined. This method is often used when the quantity consumed is very small, or when the exact count or measurement of the material at the time of its consumption is wanted. In cases of this kind, the amount of material which enters the product is ascertained by exhaustive tests. The result of these tests, which show the average consumption of material and its cost, may be recorded on specifications which form the basis for future charging of material consumed. For example, the glue used in the manufacture of chairs must be determined in the way indicated. If a test run of 100 chairs is made the amount of glue actually used on this test may be weighed and the total cost of the glue

charged. In this way it is possible to develop a formula of requirements from units so as to determine the amount of glue to use. Unless such a method is adopted, the glue used must be considered as a factory supply and be included in the factory overhead expense.

Determining Costs by Points. When a workman takes lumber or other material and cuts out of it parts for four or five units of product, with resulting scrap from which parts for other products can be evolved, the proper distribution of labor and material costs is a problem. Costs under such conditions may be determined by points.

Under this method a shop order is used covering whatever pieces the cutter is likely to get out of his material in a specified time. A week is a convenient period. For the first two or three days after the plan is instituted, the cutter keeps "tab" on the average length of time devoted to each part of his product, and a record of his time is made by "points" so as to establish a comparative scale whereby the labor costs may be equitably distributed.

The time required to produce the largest piece of product or the one consuming the greatest amount of labor is set at ten points. The next piece by comparison of average time consumed may, perhaps, be properly fixed in the scale at eight points, and so on down the line to the piece consuming the smallest amount of labor.

A count is necessary in order to ascertain the total product for the period. This may be an actual physical count, or the product may be ascertained by

measurement in the case of wood or by weight in the case of metal.

Assuming that we have under consideration wood parts and that the week's product includes 56 parts of ten-point product, with a total of 560 points; 183 parts eight-point product, with a total of 1,464 points; 79 parts of seven points, with a total of 553 points; and 127 parts of two points, aggregating 254 points, we have a grand total for the week of 2,831 points.

The labor cost having been, say, $18.00 for the week of fifty-four hours, the value of one point is easily ascertained to be $.0064 and the time consumed per point to be 1.144 minutes. The former is to be used as a basis of labor costs by extending the points on each part to secure the labor cost on such parts. The latter is to be used as the basis of expense, or overhead, under any of the plans of expense distribution which use labor time as a basis of diffusion.

The material can be apportioned in like manner either on a basis of "size" points, or by the exact measurements of each part plus a percentage loading to cover waste on actual results. This percentage is obtained by tests each month.

When this method of costing is practiced, any stock removed before the end of the week should be removed by known quantities so that the record may not be lost.

The point plan is applicable wherever a number of parts are cut out or otherwise treated at the same time, as also in any operation where several parts which cannot be kept separate are worked on by one workman, or again, where the workman cuts material into any one of a dozen different patterns according as the material may cut to advantage.

Chapter XXII

INSTALLING A COST SYSTEM

The installation of cost accounting systems is beset with numerous difficulties. The manufacturer thinks immediately in terms of "red'tape." The superintendent and foreman fear the exposure of their inefficiencies, and the workers become suspicious, feeling that the proposed cost system will reduce their wages. None of these attitudes should be apparent if the installation and its objects are frankly stated to the entire factory personnel. The objects of any cost system, besides obtaining analytical information, are to increase production, eliminate waste, reward labor in proportion to its effectiveness, extend to foremen and executives the proper knowledge, so that factory administration may be highly efficient, and to help create industrial prosperity. If these objects are made clear there can be no objections of any importance.

A cost system installation surrounded with secrecy will always arouse suspicion. It is well to again emphasize that when an installation is contemplated, the entire factory personnel should be notified, the objects of the system explained, and the coöperation of all solicited.

The Starting Point. The author has often heard cost accountants discuss the starting point of a cost system installation, and quite universally the conclusion was to "start at the beginning," meaning the raw material inventory. In our frank opinion that is the

place to end. An investigation of storerooms will not disclose the store requirements, the processes of manufacture, nor the finished products on which costs are desired. We are inclined to believe that the installation of a cost system should start at the end, that is, with an analysis of sales in order to determine the classes of product for which costs must be determined. The chart shown in Figure 58 outlines a general plan to follow.

In Figure 58 we have not enumerated the elements involved in the production of Product B, because the details given for Product A are sufficient. In some cases, both products might utilize some of the same departments. This would probably be true of the final assembly department, and might also be the case with regard to the subassembly department. For the manufacture of distinct parts, separate departments generally exist. This arrangement is quite desirable. While the lines with arrows indicate the march of production from raw material to finished product, that knowledge cannot be gained by starting the cost investigation in the raw materials storerooms. The investigation must march backward from the finished-products storeroom, and from there the analysis or separation of all the elements of cost must begin.

Finished-Products Formula. A study of the finished products, the costs of which will be reflected in the General Ledger Finished Inventory and Cost of Sales accounts, should immediately reveal the component parts contained therein and the departments contributing to their assembly. If we start with Product A for an example, we can see that the product in its final form is a combination of finished parts, subassemblies,

and some raw material. The product can be represented by a formula showing the quantities of the various components necessary for one unit. If the product is made up on an assumed formula of three finished parts, two subassemblies, and four distinct units of raw material, and the sales indicate the quantity of the finished product to be carried in stock so as to secure a maximum turnover, one can prepare a schedule of production requirements for the subassembly and the parts manufacturing department, and a minimum and maximum index for those raw materials entering into final assembly (at least as far as Product A is concerned). A specification sheet for Product A will be necessary, and will, in fact, be the formula to which we have just referred.

The finished product inventory necessary to secure the proper turnover thru sales should be established, and this, in connection with the specification sheets, will show the entire production requirements for all the departments fabricating the parts and subassemblies needed in the final assembly. The stock records for the finished products must be drawn up so as to show the final assembly order number, the date of finishing the order, the date accepted thru inspection, the number of units, the total cost, the addition for storage expense, the total value, the unit value on the debit side, the date shipped, units shipped, unit value, and total value of shipments on the credit side. In addition, there should be a "balance on hand" column in which the units and their value should be shown, and at the top of each commodity sheet a clear description of the product as well as the minimum and maximum index. The credits will give the values to

be reflected in the Cost of Sales Account, and the units indicated as shipped should agree with the sales journal quantity columns.

Having determined the quantities of finished products to be manufactured each period, in order to adequately meet sales requirements, the next step is naturally the organization of the final assembly department and the determination of the cost factors in that department. This implies a study of the processes involved in final assembly, because upon the nature of these processes will depend the character of the cost system, and especially the plan or method of overhead application to product. If the final assembly is principally hand work performed by skilled mechanics who receive about the same wages and who perform work of about the same character, the overhead for the department may be distributed to product, either on the direct-labor hour or the direct-labor wage basis. If the final assembly work is performed chiefly by machines, then the machine-hour rate method for overhead allocation should be employed. Any skilled hand labor should be localized into production centers, the latter receiving the same treatment as machines. The methods of applying overhead to production orders, as well as the methods to be utilized for tabulating the costs of labor and materials was explained before.

Altho the cost accountant is not generally an industrial engineer, he should study the cost situation in any department from both the cost and the production angles, and if necessary he should secure the coöperation of an industrial engineer. Having seen the requirements of the sales department and the needs of the finished-products storeroom, and studied the

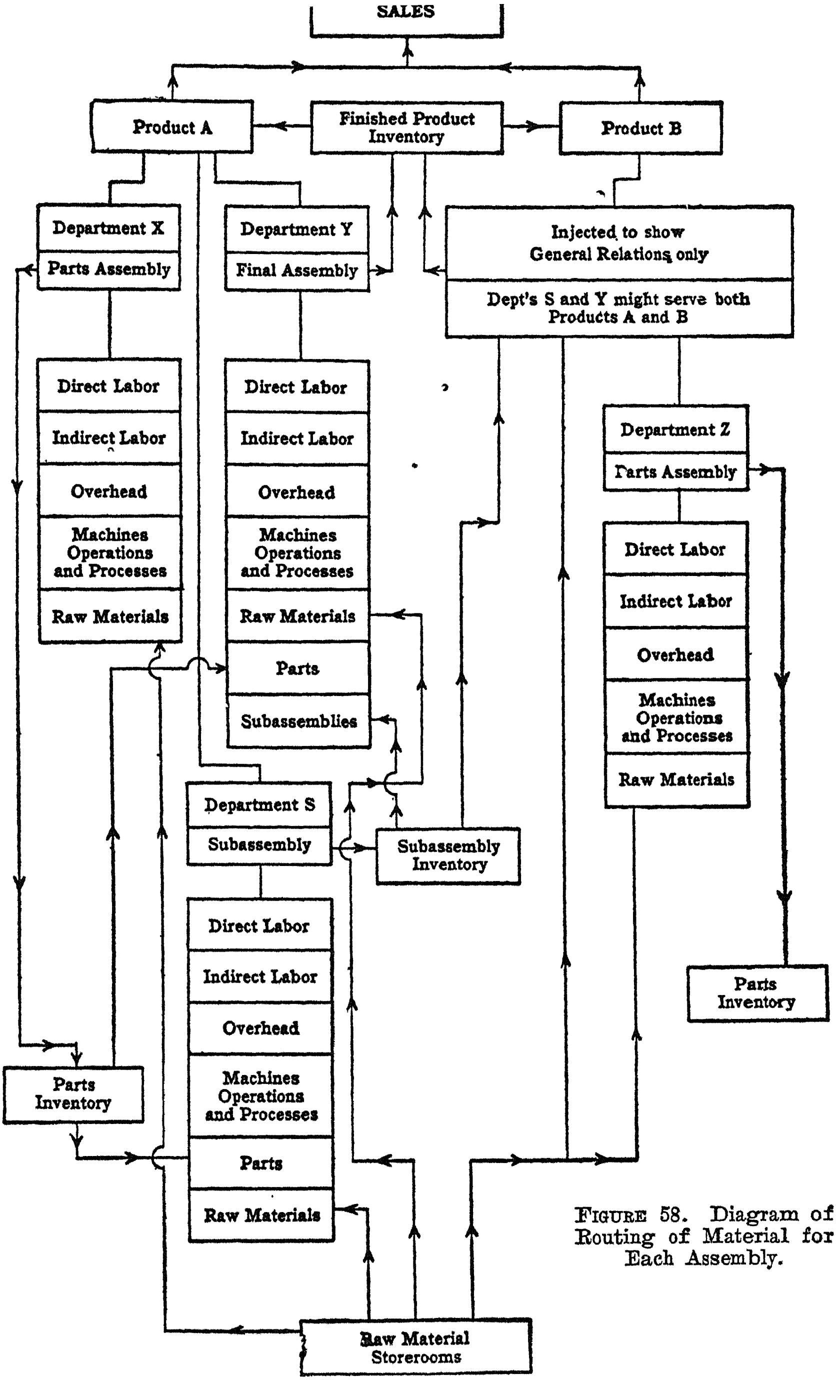

FIGURE 58. Diagram of Routing of Material for Each Assembly.

processes thru which the finished product is assembled, the cost accountant should be able to prepare a routing sheet for each assembly. On the basis of this information, he should then be enabled to furnish advice as to the proper location of machines and equipment, the adequacy of machine investment, and the proper proportioning of machines and equipment. Thru an analysis of the actual costs, he should also be able to recommend the elimination of any wasteful operations or the introduction of time or money saving devices.

If Product A requires three finished parts and two subassemblies, then, as shown in Figure 58, as far as Product A is concerned, the manufacturing requirements for the parts department and the subassembly department are known. When the final assembly requirements of all products are known, it then becomes possible to make a study of the subassembly and parts production departments in much the same manner as recommended for the final assembly department. The entire production program of these departments must be arranged so as to secure the properly proportioned output for each successive stage in the whole manufacturing process. The parts to be manufactured must be in proportion to the demands of the subassembly and final assembly departments. The subassemblies made must satisfy the requirements of the final assembly department, and the latter must be prepared to meet the sales requisitions as these are made, unless the whole plant is a special-order establishment.

During the course of a cost system installation, constant contact will be had with departmental store needs. In fact, unless the installation is made in a very superficial way, the study of each department will

show the needed stores and parts which are peculiar to each particular department. When this is known, it becomes possible to recommend the proper location for storerooms, giving to each department those stores for which an exclusive or almost exclusive need exists, and placing in a general storeroom, centrally located, those stores which serve all departments about equally.

Detailed Study of Departments. The work in connection with a cost system installation will proceed from the final assembly department down thru the sub-assembly and parts production departments. In this entire process, the same detailed study of each department must be made, and each department must be given a system which will most accurately establish the real costs. This may mean a variety of costing methods, especially with reference to factory overhead, but unless accuracy is obtained the system will be valueless.

We have continuously and, we believe, persistently advocated in this work the constructive value of cost accounting and the need for a constant alliance between cost accounting and production programs. No production problem can be adequately solved without a knowledge of production costs, and, if the object of cost accounting is cost reduction, no cost system can permanently succeed without a full consideration of production problems. If a cost system is truly analytical in its expression, and always raises the questions of "why," "how," and "when," it may indeed be considered a worthy aid to industry.

Chapter XXIII

STANDARD COSTS AND THEIR APPLICATION

Numerically considered, not many manufacturing concerns are using standard cost systems. Those few that are using them, however, are, as a rule, quite large and profitable industries.

It is absolutely necessary for the cost accountant to know the methods employed in obtaining job or production order costs, such as this work has outlined. It will be equally necessary for him, if his outlook is progressive, to know how a standard cost system works.

What Are Standard Costs? A standard cost is, literally, a fixed predetermined cost of a product. This fixed cost represents a yardstick against which actual costs are measured. The more radical proponents of standard costs say that any yardstick will do and may therefore be used indefinitely; a standard to them is merely a measuring device by means of which the tendencies in actual costs may be discerned and expressed. Quite naturally, the standard or standards adopted will bear some relation to normal conditions and costs in an industry. However, standards in this sense are not "efficiency" standards but constant, fixed units of measurement. It is upon this conception of standard costs that the following discussion is based.

Illustrating Standard Costs. Assume that a manufacturer makes Product A and that the following material, operational and factory overhead costs are fixed as standard:

1. Material Content and Costs:

Kind of Material	No. of Units	Standard Price	Total	
X	3	$2.50	$ 7.50	
Y	2	1.00	2.00	
Z	6	2.00	12.00	
				$21.50

2. Direct Labor Costs:

Operations	Hours	Standard Rate	Total	
1	12	$ .80	$9.60	
2	10	.75	7.50	
				17.10

3. Machine Hour Overhead:

Machine	Hours	Standard Rates	Total	
M	12	$2.00	$24.00	
N	10	1.50	15.00	
				39.00

4. General Overhead:

Department	Direct Labor Hours	Dept. Stand. Rate	Total	
B	22	$ .25	$5.50	5.50

Total Standard Cost Product A..............................$83.10

By way of explanation, $21.50 represents the material standard, $17.10 the direct labor standard, and $39.00 and $5.50 the respective overhead standards, making the total standard $83.10. In other words, $83.10 is the yardstick for measuring the actual costs of producing Product A, and the various component standards for materials, direct labor, and overheads are the yardsticks by means of which the actual costs of these various components are measured.

It should also be noted that these standards are quantity as well as price standards. That is to say,

not only are the units, of the classes of materials used, standard quantities, but the pricing of these units is also at standard prices. Similar considerations appear in connection with the Direct Labor and the Overhead Standards.

Standard Cost Accounting Procedure. It is quite apparent that various methods of cost accounting may be devised in connection with standard costs, the objects of which must be to show the standard costs, the actual costs, and the variations between actual and standard costs. We must remember always that we have both quantity and price standards with which to deal.

1. Standard Material Costs

In dealing with Standard Material Costs where shall we start? Shall it be with the inventories of materials and stores, or with the materials and stores as these leave the storeroom to go into production?

If we start with the inventories, we shall have to show these at both actual cost prices and at standard prices; that implies that each invoice for materials purchased must show standard pricing or values in addition to the actual purchase cost. The stores ledgers will then show inventory balances, additions and withdrawals at actual cost and at standard cost; requisitions for withdrawals will also have to be costed both ways.

The need for this procedure is apparent when we remember that actual costs must always be known and determined under a plan of standard cost accounting.

STORES LEDGER

Standard Unit Price $2.50 — Material X — Max. 100, Min. 75

Date	Received			Disbursed			Balance		
	Units	Standard Price	Actual Cost	Units	Standard Price	Actual Cost	Units	Standard Price	Actual Cost
Jan. 1							80	$200.00	$204.00
Jan. 2	10	$25.00	$25.25				90	225.00	229.25
Jan. 31				A3	$7.50	$7.65	87	217.50	221.60

STORES LEDGER

Standard Unit Price $1.00 — Material Y — Max. 50, Min. 30

Date	Received			Disbursed			Balance		
	Units	Standard Price	Actual Cost	Units	Standard Price	Actual Cost	Units	Standard Price	Actual Cost
Jan. 1							40	$40.00	$39.20
Jan. 10	5	$5.00	$4.90				45	45.00	44.10
Jan. 31				A2	$2.00	$1.96	43	43.00	42.14

STORES LEDGER

Standard Unit Price $2.00 — Material Z — Max. 100, Min. 90

Date	Received			Disbursed			Balance		
	Units	Standard Price	Actual Cost	Units	Standard Price	Actual Cost	Units	Standard Price	Actual Cost
Jan. 1							90	$180.00	$171.00
Jan. 15	8	$16.00	$15.20				98	196.00	186.20
Jan. 31				A6	$12.00	$11.40	92	184.00	174.80

Suppose that we refer again to our illustration concerning Product A, on page 330. Note that three kinds of material were used, namely, X, Y, and Z. The stores ledger, say at the beginning of any particular month, might appear as shown on page 332, with regard to these materials.

These forms are purely suggestive in that more or less information might be desirable under certain conditions. The letter "A" in each "Disbursed" column indicates withdrawals for Product A. In Material X, the actual costs are higher than the standard, but there is a decrease in actual costs on the 10 units received on January 2, 19—. The quantities disbursed on January 31, 19—, were priced, for actual cost purposes, on the basis of the actual per unit cost on January 1, 19—, namely, at $2.55. Probably that unit cost would be used for the entire month of January, whereas, in order to average actual costs in February, a unit cost of $2.5471+ could be used. In Materials Y and Z the purchase costs did not vary from the inventory cost as at January 1, 19—.

We have assumed, as the entries for withdrawals show, that standard quantities were used, namely, 3 units of X, 2 of Y, and 6 of Z.

On the basis of the above transactions what entries would have to be made? What do we want in our Goods in Process account—actual costs or standard costs? Standard costs, of course. Hence the following entries:

Product A in Process	$21.50	
To Inventory: (Material X)		$ 7.65
(Material Y)		1.96
(Material Z)		11.40
Material Price Variation		.49

Note: To charge In Process Account Product A with Standard Material Costs, to credit Inventory accounts at actual costs of materials used, and to reflect price variation on materials, as follows:

	Over Standard	Under Standard
Material X	$ .15	$
Material Y	..	.04
Material Z	..	.60
Total	$ .15	$ .64
Net Under Standard	.49	...
	$ .64	$ .64

The actual cost value of the material content of Product A In Process would naturally be $21.01 ($21.50 Standard, minus $.49 Variation from Standard due to price differences).

But suppose that more or less of the quantities of Materials X, Y, and Z were used. Let us assume that an additional unit of Material X was used (4 instead of 3) and a half unit more of Y. The actual usage of materials at actual costs as contrasted with the standards would be as follows:

Standard Material Costs				Actual Material Costs			
Materials	Units	Unit Cost	Cost	Materials	Units	Unit Cost	Cost
X	3	$2.50	$ 7.50	X	4	$2.55	$10.20
Y	2	1.00	2.00	Y	2½	.98	2.45
Z	6	2.00	12.00	Z	6	1.90	11.40
Total			$21.50	Total			$24.05

The actual costs exceed the standard costs by $2.55, but the excess is due to both quantity and price variations. Our entry then with explanation would be as follows:

Material Quantity Variation	$ 3.00	
Product A in Process	21.50	
To Inventory: (Material X)		$10.20
(Material Y)		2.45
(Material Z)		11.40
Material Price Variation		.45

Note: To charge In Process Account Product A with standard material costs, to credit Inventory accounts at actual costs of materials, and to reflect price and usage variation on materials, as follows:

Price Variation	Over Standard	Under Standard
Material X	$ .20	$
Material Y		.05
Material Z		.60
Total	$ .20	$ .65
Net Under Standard	.45	
	$ .65	$ .65

Inventory or Usage Variation	Over Standard	Under Standard
Material X	$2.50	$ . .
Material Y	.50	. . .
	$3.00	None

2. Standard Labor Costs

Just as materials used may be above or below standard usage, and may also show a price variation, so the actual number of labor hours may exceed or be less than the standard hours, and the labor rates may also vary. Suppose the actual labor costs as contrasted with standard costs on Product A (see page 330) are as follows:

Standard Labor Costs			
Oper.	Hrs.	Standard Rate	Total
1	12	$ .80	$9.60
2	10	.75	7.50
Total			$17.10

Actual Labor Costs			
Oper.	Hrs.	Actual Rate	Total
1	13	$ .80	$10.40
2	10	.70	7.00
Total			$17.40

The accrued wages account or vouchers payable would naturally have to be credited with the actual liability incurred for labor costs. In Journal form the following entry would record the facts:

Product A in Process	$17.10	
Labor Usage Variation	.80	
To Labor Rate Variation		$ .50
Accrued Wages		17.40

Note: To charge In Process Account Product A with standard labor costs, to credit accrued wages with actual wage liability, to charge Labor Usage Variation Account with excess labor time, and to credit Labor Rate Variation Account with difference between actual labor rate and standard labor rate.

3. Standard Overhead Costs

The illustration of total standard costs on Product A as shown on page 330 gives a standard factory overhead cost split in two parts, namely, that created through the ownership and operation of the plant as a physical property, and that produced by the activities of various personnel factors, composed usually of such items as supervision and departmental indirect labor. In this illustration it is assumed that both machines M and N are in Department B, and that the direct labor hours and machine hours coincide, as they usually do when the direct labor is at machines.

The standard overhead rates are set for each machine or group of like machines, and for the department (for General Overhead) in practically the same manner as heretofore described for the Production Order plan of costing. In allocating factory overhead to product we may also encounter a difference or variation between the standard rate and either the actual overhead or a rate set for current purposes.

Suppose that the following contrasts are revealed in the manufacture of Product A:

Standard Overhead

A. Machine Hours:

Mach.	Hrs.	Standard Rate	Total	
M	12	$2.00	$24.00	
N	10	1.50	15.00	
				$39.00

B. General Overhead:

Dept.	Hrs.	Rate	Total	
B	22	$ .25	$ 5.50	5.50
Total Standard Overhead				$44.50

Actual Costs Based on Present Rates Used

A. Machine Hours:

Mach.	Hrs.	Rate	Total	
M	13	$2.10	$27.30	
N	10	1.40	14.00	$41.30

B. General Overhead:

Dept.	Hrs.	Rate	Total	
B	23	$ .24	$ 5.52	5.52
Present Rate Overhead				$46.82

The Journal entry needed to reflect these conditions would be as follows:

Product A in Process	$44.50	
Overhead Usage Variation	2.25	
Overhead Rate Variation	.07	
To Reserve for Factory Overhead		$46.82

Note: To record standard overhead charge to Product A In Process, to set up reserve for total overhead on basis of present rates in use, and to record overhead variations from standard, as follows:

	Usage Variation	Rate Variation	
Mach. M. .	$2.00 (1 hr. overuse)	$1.30 Rate Overage	
Mach. N.			$1.00 Rate Gain
Dept. B. .	.25 (1 hr. overuse)		.23 Rate Gain
	$2.25	$1.30	$1.23
		Net Rate Overage .	.07
			$1.30

On the basis of the Journal entries beginning on page 330 (the entry debiting Product A In Process $21.50 and Material Quantity Variation $3.00), we can now construct the various ledger accounts affecting

the entire standard costs of Product A, the actual costs, and the variations. These accounts will be as follows (using the T form):

Product A In Process			
Material	$21.50		
Direct Labor	17.10		
Overhead	44.50		

Inventory of Materials			
		Material X	$10.20
		Material Y	2.45
		Material Z	11.40

Material Price Variation			
		Product A	$ .45

Material Quantity Variation			
Product A	$3.00		

Labor Usage Variation			
Product A	$ .80		

Labor Rate Variation			
		Product A	$ .50

Accrued Wages			
		Product A	$17.40

Overhead Usage Variation			
Product A	$2.25		

Overhead Rate Variation			
Product A	$ .07		

Reserve for Factory Overhead			
		Product A	$46.82

Taking a trial balance of the above ledger accounts, we have:

Product A Trial Balance

Account	Debit	Credit
Product A in Process (At Standard Costs)	$83.10	
Inventory of Material		$24.05
Material Price Variation		.45
Material Quantity Variation	3.00	
Labor Usage Variation	.80	
Labor Rate Variation		.50
Accrued Wages		17.40
Overhead Usage Variation	2.25	
Overhead Rate Variation	.07	
Reserve for Factory Overhead		46.82
Totals	$89.22	$89.22

This trial balance, which has been prepared for Product A only, shows us the total standard cost of

the product and how and where the standard cost varies from the actual. The actual cost is naturally the sum of the standard cost and the variations. It would be computed as follows:

Standard Cost Product A			$83.10
Add and/or Deduct Variations:			
Add Variations--			
Material Quantity		$3.00	
Labor Usage		.80	
Overhead Usage.		2.25	
Overhead Rate		.07	
		$6.12	
Deduct Variations--			
Material Price. . .	$ .45		
Labor Rate.	.50	.95	5.17
Total Actual Cost			$88.27

The total actual cost of making Product A can again be proved by looking at the various tables of actual component costs on pages 334, 335, and 337. They give us the following information:

Actual Material Costs.	$24.05
Actual Labor Costs	17.40
Actual Overhead Costs	46.82
Total Actual Cost	$88.27

The illustration given deals with one unit of Product A only; there would be no difference in the treatment no matter how many units were being produced. As any number of units of Product A were completed, Product A In Process Account would be credited at the invariable standard cost ($83.10 per unit) and Product A Finished Account would be charged. As units of Product A were sold, Cost of Sales (Product A) would be charged (at standard cost) and Product A Finished Account credited.

It should be borne in mind, at this point, that even though the charge to cost of Sales is at standard cost, the variation accounts are always there to disclose the differences between standard and actual costs, and that the periodic profit and loss statements will contain the adjustments needed to show the actual costs; the variations from standard will be a part of those statements and may appropriately be deducted from or added to the standard gross profit, especially in those cases where standard selling prices are used on the Profit and Loss statements—a practice recommended by quite a few adherents of the standard cost plan. Naturally, variations between actual sales prices and standard sales prices will also be disclosed and accounted for.

General Considerations

Those advocates of standard cost systems who propose fixed standards as measuring devices only, thereby disclosing the variations, either up or down, of actual costs from standards, must provide an additional yardstick or their entire plans would be useless. That additional yardstick must be an efficiency standard, or an efficiency index, which will also show the actual costs in contrast to a more or less ideal cost.

We should never forget that actual costs, under hundreds of varying conditions of production, many of them indicative of considerable shortcomings and errors in practice, are not necessarily real costs. Real costs are costs as they ought to be under the best possible operating conditions, after, of course, making due allowances for unavoidable errors and shortcomings.

Standard cost advocates naturally have appropriate efficiency tests in mind and use them to assist in bringing about needed changes in manufacturing conditions. However, it has not been their practice to consider true costs as the basis for production values—in the long run they all get back to actual costs for inventory purposes, even though they do know what true costs are and how the actual costs vary from true costs.

After all, the important thing in manufacturing is not to know how actual costs vary from a fixed, measuring device, but how far actual costs are at variance with true costs; i.e., costs as they ought to be.

Why not use true costs as a standard? A "true" cost standard would answer all purposes but it could not be a fixed standard because "true" costs change with every improvement in manufacturing methods.

Efficiency Costs. True costs, or efficiency costs, are those representative of the best possible use of materials, labor, and plant facilities, both quantitatively and qualitatively considered. That means the best possible use of materials, the best possible use of labor, and the best possible use of plant, at the best possible cost.

Whether or not price standards for materials and standard labor rates should be used would depend entirely upon the nature of the control over purchasing and labor. If a standard is to be used which is to find its way into the inventories, as representative of a correct cost, actual costs of material and actual direct labor rates should doubtless be used. If they are not

used, we would have to assume that the purchasing agent and the employment manager are able to influence the costs of materials and the price of labor. Such an influence may exist in isolated cases but it is not general; a system should hardly be created on the basis of exceptions. At any rate, there are other methods of controlling these things or knowing about them; they need not, therefore, be considered as an integral part of a standard cost system.

Assuming that prices of materials and labor rates are not ordinarily under the control of purchasing agents and employment managers, the most important factors to be considered in fixing an efficiency standard for materials and labor are quantitative in nature; that is, the number of units of materials and the number of hours of labor are the essential considerations in fixing material and labor standards on an efficiency basis.

When we come to factory overhead, we are again confronted with an opportunity to use efficiency standards; that very use will enable us in time to bring about the most efficient use of machinery, plant, power, general factory departments, and indirect labor. Thus, a machine should be burdened with a proper amount of depreciation each year and with its proper quota of tax, insurance expense, and repairs; definite knowledge as to power requirements, machine speed, and advantageous location in a series must be had. All these factors must receive consideration so that an efficiency standard for the overhead allocated to the machine may come into use.

For machine-hour rates, the best possible capacity performance should be used, because that is the goal we should endeavor to attain. Variations from such a standard will be the measure of our shortcomings no matter what they may be. Thus, if the hours of operation, set as a standard for say a year or six months, are not obtained, we may know that the deficiency is due to either a lack of internal factory control and adjustments or to slack business which may be avoidable or unavoidable; the use of the standard will indicate the cause of nonuse or misuse. Nonuse will become a charge to Unearned Burden Account; misuse will be a charge to Machine Overhead Variation Account.

We must be on guard, at all times, however, when we set efficiency cost standards, that the standards are reasonable and representative of possibilities; they must be judged and fixed in accordance with the plant capacity factor; that's not 100 per cent capacity but the best possible capacity as revealed by an examination of performance capabilities. All factors of unavoidable shortcomings must be considered.

At the same time, the fixing of rates should be based upon the best possible capacity in every sense. This fact cannot be emphasized too strongly. Even though a plant may not ever have been worked to that capacity point, a standard rate based upon any other consideration will not disclose fully one of the most important of all business costs—the cost of idle capacity.

The Efficiency Standard Plan. Probably an illustration of an efficiency cost standard is now appropriate. Assume that in the manufacture of Product B, three classes of materials are used (C, D, and E), that the product passes through two operations F and G on machines H and I, respectively, in Department J where the direct labor-hour rate for general overhead, on an efficiency basis, is $.30 per hour.

Material Standard

An absolute 100 per cent material specification for Product B indicates that the following quantities of material are needed, that is, they form the final content of the product:

Material Efficiency Cost Standard

Materials	Units	Unit Cost		Total
C	6	$1.00		$ 6.00
D	15	.50		7.50
E	10	.80		8.00
Total Based on Absolute Formula				$21.50
Additional units required to obtain best possible use of material after making due allowance for unavoidable shrinkage and waste:				
Material C	1/10 @	$1.00	$ .10	
Material D	1/5 @	.50	.10	
Material E	1/10 @	.80	.08	.28
Standard Material Cost (On Efficiency basis) at present cost of materials				$21.78

Direct Labor Standard
(Based on Expert Performance)

Operations	Hours	Labor Rate	Total
F	10	$ .75	$ 7.50
G	10	.80	8.00
Total Expert Costs and Time of Labor .			$15.50

Additional hours allowed to provide for best possible performance under existing conditions:

Operation F	½ hr. @ $ .75	$ .375	
Operation G	1 hr. @ .80	.800	1.175

Standard Director Labor Cost (On Efficiency basis) at present labor rates . $16.675

Machine	Machine Overhead Efficiency Hours	Standard Machine Rate	Total
H (Oper. F)	10.5	$2.00	$21.00
I (Oper. G)	11.0	3.00	33.00

Total Standard Machine Overhead . . .	$54.00
Add—Department J General Overhead at direct labor hour efficiency rate 21.5 hrs. @ $.30	6.45
Total Factory Overhead Standard (On Efficiency basis) for Product B	$60.45

The Procedure Illustrated

(Using Journal entries)

The following composite Journal entry indicates the line of cost accounting and the values that are placed into Goods in Process Account:

Product B in Process	$98.905	
Material Variation Account	.180	
Direct Labor Variation Account	.250	
Machine Overhead Variation Account	.670	
Department Overhead Variation Account	.100	
To Raw Materials Inventory		$21.960
Accrued Wages		16.925
Reserve for Factory Overhead		61.220

(Explanation: To value Inventory in Process at Efficiency Standard Costs, to credit Raw Materials Inventory Account with actual costs of all materials used, to set up liability for wages, to credit Overhead Reserve Account for overhead used, and to reflect excess materials used, excess labor used, and excess overhead by means of variation accounts, as follows:

Material Efficiency

	Standard Units	Actual Usage Units	Excess Usage	Unit Cost	Excess Cost
C	6 1/10	6 3/20	1/20	$1.00	$ .05
D	15 1/5	15 3/10	1/10	.50	.05
E	10 1/10	10 1/5	1/10	.80	.08
Total Excess over Standard					$ .18

Direct Labor Standard	Efficiency Hours	Actual Labor Hours	Excess Labor Hrs.	Actual Rate	Excess Cost
Oper. F	10.5	10 5/6	1/3	$ .75	$ .25
Oper. G	....	......	...	.....	None
Total Excess Labor Cost over Standard					$ .25

Machine Overhead Efficiency Standard	Actual Hours	Excess Mach. Hrs.	Machine Rate	Excess Mach. Cost
Mach. H (Oper. F) 10.5 hrs.	10 5/6	1/3	$2.00	$ .67

Department Overhead
Efficiency Standard:

Dept. J General Overhead Efficiency Standard	Actual Hours	Excess Dept. Time Hrs.	Dept. Hr. Rate	Excess Dept. Overhead
Hrs. on Prod. B (Oper. F) 10.5	10 5/6	1/3	$ .30	$ .10

Thus fixing the variations arising out of improper use of material, labor and plant facilities as follows: Material $.18; Direct Labor $.25; Machine Overhead $.67; and Department Overhead $.10.

For purposes of the above Journal entry we have assumed an improper excess use of materials, an excess of labor hours over standard, and an excess use of plant. These deficiencies are usually coincidental, that is, when excess material is used more labor time is used to work on the substitute materials needed because of spoilage, and naturally machine time and departmental time will be greater by the amount of the excess direct labor hours.

Inventory Values

It should be observed that the described Efficiency Standard cost method does not adjust the inventories of goods in process or of finished goods to the actual costs. Consequently, the cost of sales account will be at standard. The variation accounts are not used to bring standard costs up to actual but are to be considered as pure profit and loss items; they are the

measure of operating errors that have been determined as avoidable. Errors do not and should not be considered as creative of values. Again, we must emphasize that actual costs are not true costs—efficiency costs are the closest approximation to true costs and may therefore be regarded as virtually true costs for each particular plant.

Of course, efficiency standards and therefore efficiency costs will vary as between plants making even identical commodities. That condition cannot be avoided as long as we have some plants better built, better manned, better equipped, and better controlled than others. There is quite obviously an efficiency cost for an entire type of production, regardless of plant type, which would usually be represented by the cost of the most efficient producer. In industry, as a whole then, there are great variations in all the elements of cost which measure the gap between the most efficient manufacturers and the marginal producers. Some day we may come to know something about national industrial cost accounting upon a basis of efficiency standards; society may then be spared the enormous toll that it now pays so that the marginal producer may remain in business.

At present, we must console ourselves with the recommendation that each individual plant should have its own efficiency standard costs, and that they use these not only as a basis for building up their inventory values but also as a corrective index for more economical and efficient production; when effectively used as a corrective, efficiency standard costs auto-

matically tend to establish inventory values on an efficiency cost basis; that will help each manufacturer directly and society indirectly—it will move up the index for the marginal producer. In other words, many of the present high-cost, inefficient producers will be eliminated.

As to inventory valuation, we could hardly be justified, at this time, in recommending that the efficiency costs of the ablest producer in each particular industry be the basis of that valuation, but we ought surely use an efficiency cost basis for each particular producer. We should not inventory the cost of mistakes and errors; misuse of plant does not create value any more than nonuse. We are probably all pretty well agreed that idle capacity is a business loss and not a cost of production; improperly used capacity is equally a business loss.

It is for these reasons that under an efficiency standard cost system only present true costs, individually considered for each manufacturer, should find their way into the values of inventories in process and finished product.

Efficiency Costs in the Production Order System. The vast majority of manufacturers still use the Production Order or Job Order system of cost accounting. Many of them refuse to consider the Standard Cost methods outlined at the beginning of this chapter. It may be true that the Standard plan is not universally applicable.

At any rate every cost accountant must be fortified with a knowledge of Production Order cost methods such as those to which this work has been dedicated.

But, at the same time, whether a manufacturer uses the ordinary Standard cost accounting or the Production Order plan, he should test either by means of Efficiency Standard Costs and use these latter costs in his inventories of goods in process and finished goods.

We know how the plan works when we use Efficiency Costs as a standard, but what can be done when Production Order systems of costing are used?

The answer is quite simple.

If you will refer to page 54 (Illustration of Material Cost Sheet for Production Order No. 131) you will find the standard costs shown in contrast to the actual costs on a representative Production Order. The standard costs amount to $303.50—these are Efficiency Standard costs.

The actual costs of materials on that order charged to Production Orders in Process amount to $313.17. In order to reduce the inventory in process account to standard, the following Journal entry would suffice:

```
Material Cost Variation . . . . . . $9.67
     To Production Orders in Process . . .  $9.67
(To reduce Inventory in Process to an Efficiency
Cost basis because of the following excess in
materials used over standard:
Material A  20 units @ $.43 1/3 . . . . . . $8.67
Material B   2 units @  .50 . . . . . . . .  1.00
                                            -----
          Total Variation . . . . . . . . $9.67)
                                            =====
```

By reference to page 78, you will find that the total actual labor cost on the same Production Order amounts to $42.50, whereas the Efficiency standard is $40.425. Since $42.50 has been charged to Production Orders in Process, we can reduce that account to an Efficiency cost basis by debiting Direct Labor Variation Account and crediting Production Orders in Process, respectively, with $2.075, giving a detailed explanation as to how the difference is accounted for.

Now, if 2.1 extra, and assumed needless labor hours were given to Production Order No. 131, then the machines and the department utilized, respectively, also gave 2.1 hours of service as the measure of misuse. This service does not create value. It means that 2.1 times the machine-hour rate and the departmental rate for machine and departmental overhead, respectively, has been charged to Production Orders in Process, because the actual hours of use went into that account. To correct the Inventory in Process to efficiency costs, we would merely have to charge Overhead Variation Account and credit Production Order in Process.

It is therefore very simple to convert Production Order Costs, that is, actual costs to Efficiency Standard Costs. There is nothing, therefore, to hinder any manufacturer from having true values in his inventories. If he uses an Efficiency Standard Cost system he gets these true values directly into his accounts; if he uses the Job Order or Production Order system he gets them by reducing his actual costs to the efficiency costs.

Efficiency Standards Change. Unlike the ordinary standard cost system, which usually employs a fixed standard indefinitely, the Efficiency Standard Cost plan provides for changes in standards in harmony with the changes in industrial methods and mechanization; it is therefore always up to date as a corrective device, it will constantly bring true values into inventories, and it will serve, as all standards do, as an ordinary measuring device.

An efficiency standard does two things at one time—it measures and it serves as an index of efficiency. The usual standard merely measures and, in that case, an additional efficiency index must be provided; we must have these efficiency indices, no matter what plan of cost accounting we may follow. Why not use an efficiency standard cost that serves at one and the same time as a measuring device, a variation base, and a corrective; a cost plan that is flexible and that correctly interprets and expresses the changes that are constantly going on in manufacturing methods?

Standard Cost Limitations. It is doubtless true that in most all types of ordinary production of fairly stable commodities, standard cost systems are usable, and especially efficiency standard costs. But, where the manufacture is entirely or largely special, that is, where almost every job is different, it is questionable whether any advantages can be gained by the use of a standard cost system. Naturally, certain operations may be standardized by means of time and motion standards and certain other measuring indices may be

used. But very often these standards and indices are rather useless in the face of the variable materials that must be used and the varying types of labor and special machinery and tools that must be employed.

Nor has it been demonstrated by standard cost advocates that standard cost systems are always cheaper to operate. Standard cost tabulations, in many instances, do not appear to be less complicated or smaller in number than Production Order systems. Simplification to essentials is possible in both cases. We do want to know at all times what actual expenditures are—that holds for standard costs as well as for all other types of cost accounting. Whether we get standard costs first and then check them against the actual costs, or whether we reverse the process ought not to make any material difference in the time and effort of gathering the needed data.

Cost information, of course, must be current—it must show the progress and accumulation of costs day by day. This condition may be had in Job Order costs as well as in Standard costs. Planning, routing, and checking results in production is a matter of factory management and control. Standardizing material requirements, labor time, and overhead and working as close as possible to these indices is again a matter of administration, as is also the gathering of statistics with reference to the factory's operations.

The fixed standard cost system, even though it may permit of the daily entry of finished products into finished inventory account, does not thereby give us a

final knowledge of what finished inventory values ought to be, and it does not, therefore, indicate what real gross profits are.

The Efficiency Standard costs, above advocated, which are not fixed but which flex with the ever-changing coefficient of efficiency may be regarded as approximately true costs and may therefore be regarded as proper inventory values. That type of standard costing, where applicable, should be acceptable without question. Again, the same efficiency standards may be used in Production or Job order systems, to correct the actual costs or expenditures, as explained and illustrated.

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